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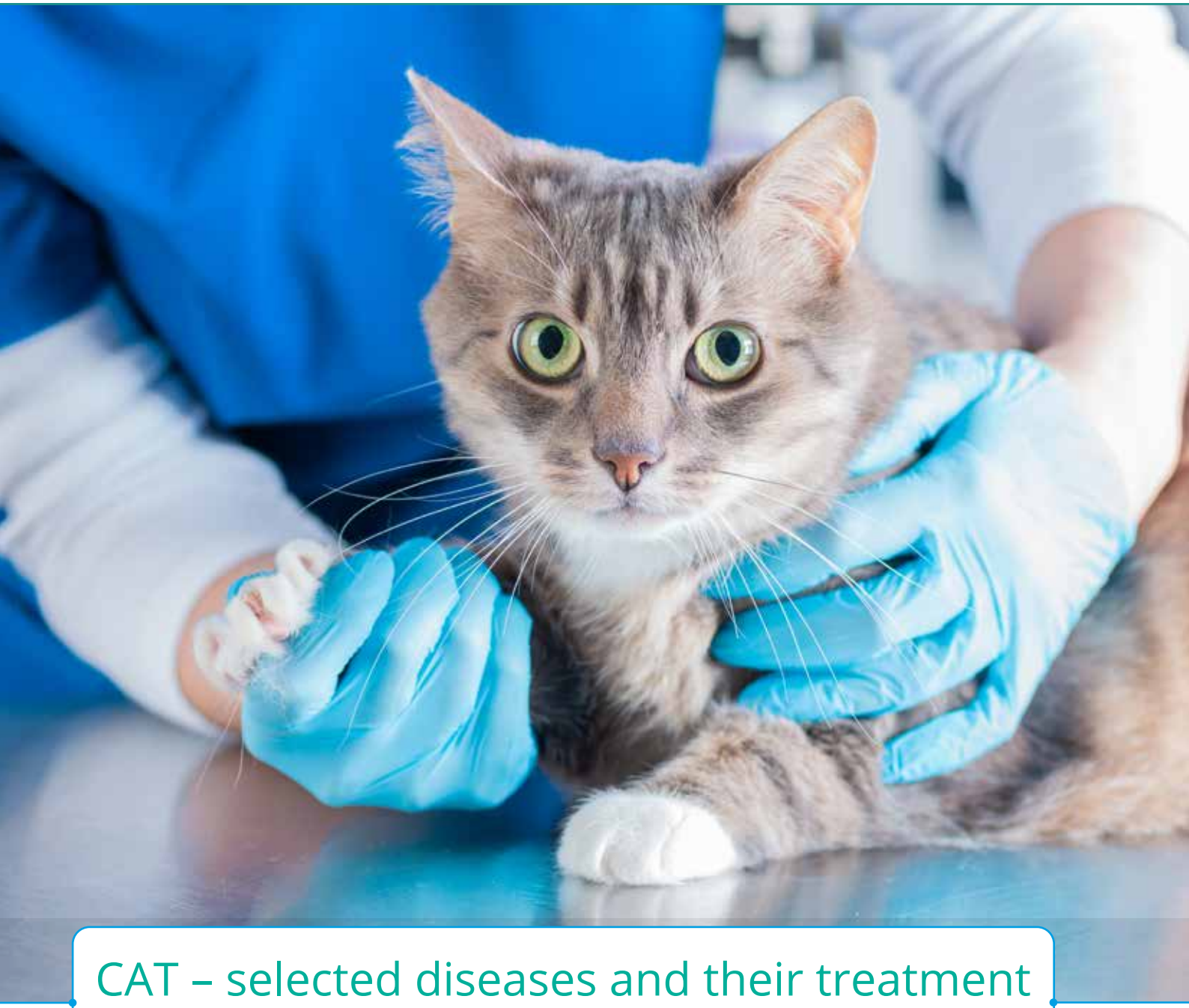

CAT – selected diseases and their treatment

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Hyperthyroidism and renal failure in cats

Triaditis in cats

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EDITORIAL PAGE

Dear Readers!

We would like to present to you our new issue of Veterinary Life entitled: Cat - selected diseases and their treatment.

Cat is a beautiful and wise animal that usually has a different opinion than a human and often chooses its own path in its life. Nevertheless, when the trail of its life's journey crosses the path of a human's life, long-term friendships are created.

Owners tend to take care of their loved ones and when their friend gets sick, they try to help it. How many diseases can be hidden in "a single cat"? For instance, we treat thyroid gland disorders and suddenly kidney failure appears. That is why we propose various articles in this issue, ranging from cardiology to gastroenterology and endocrinology category.

I would also like to draw your attention to a very interesting case study of idiopathic lymphoma in cats, as well as article focused on hypertensive encephalopathy and retinopathy in cats written by doctor Karolina Kapturska.

I hope you will also visit our Vet Pharmacy, where we showcase selected diagnostic tests as well as supplements, diets and cosmetics that may be useful in everyday practice.

Enjoy reading!

Agnieszka Kurosad
Editor-in-chief

Veterinary LiFE

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Encephalopathies and hypertensive retinopathy in cats

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Abstract: The sudden loss of vision and the development of neurological deficits in geriatric feline patients may be one of the initial symptoms of arterial hypertension, as well as secondary severe vascular and ischaemic lesions in the area of cerebral white matter or retina. These changes cause retinopathy and hypertensive encephalopathy - disorders which are rarely discussed in the literature of the subject. Proper diagnostics and pharmacotherapy are challenging. Nevertheless, an effective therapy makes it possible to restore the quality of life and reduce symptoms, as well as to prolong the life of feline patients, which survive to an old age increasingly more often.

Key words: cats, arterial hypertension, retinopathy, encephalopathy.

Introduction

According to the definition of arterial hypertension, there are three subtypes of this disease: situation-dependent hypertension (induced by stressors or related to white coat effect), hypertension secondary to systemic diseases, and idiopathic hypertension. The latter may be also referred to as primary hypertension of unknown aetiology.

Hypertension in cats usually affects elderly cats suffering from one of the following debilitating chronic diseases: renal insufficiency, hyperthyroidism, hyperadrenocorticism, or diabetes. Nevertheless, there are some doubts in the case of the latter. Within the framework of one of the studies, it was indicated that a pathological increase of arterial pressure may be observed in cats suffering from diabetes[1]. When no pathological cause can be identified, idiopathic hypertension is diagnosed. It affects between 20% up to half of the feline patients[2,3].

The most problematic in human medicine and veterinary is the inability to diagnose early symptoms of hypertension, which are quite subjective. In human medicine, they include morning headaches, facial redness, or episodes of anxiety. In cats, the clinical manifestation may include numerous although quite unspecific symptoms, such as the loss of activity, progressing lethargy, appetite fluctuations (its loss or increase), or photophobia. Indirect measurement methods, such as Doppler or oscillometry are used in clinics to diagnose hypertension in small animals[4].

Apart from the applied method, environmental conditions, stressors or circumstances affecting the patient, as well as the experience of the person performing the examination affect the achieved result[5]. Many feline patients feel more comfortable in the presence of their owner. Obviously, animal handling method may also negatively affect the reliability of the pressure measurement, predominantly due to the associated stress. A systolic pressure usually decreases with the continuation and repetition of the procedure. Moreover, the last measurement result is significantly higher than the first result, while at the same time being closer to the actual value.

Pressure	Systolic [mmHg]	Medium [mmHg]	Diastolic [mmHg]
Dog	131-154	97-115	71-96
Cat	111-162	96-138	74-116

Reference values of the arterial blood pressure fluctuate in healthy dogs and cats depending on the type of the population, techniques of measurement, and the way of handling such animals. Different publications quote various reference ranges which are presented in Table 1. The most important one is the standardization of the procedure in each veterinary practice in order to ensure the repeatability of the measurements. In spite of conducting many investigations, it is still unknown whether the arterial pressure increases with age (likewise in people). Additionally, in cats - in contrast to dogs - no breed predisposition to arterial hypertension or obesity has been observed[3]. Significantly lower values of arterial pressure were observed only in underweight cats, as compared with animals of normal body weight[6]. Recently, it has been confirmed that muscle tissue may affect measurements which are made on legs and not on a tail in cats[7].

The goal of arterial hypertension therapy is to protect (through the pharmacological reduction of blood pressure) target organs, in particular the brain, eyes, kidneys, and cardiovascular system from the so-called target organ damage (TOD). The presence of proteinuria, for example, is associated with a remarkably faster development of chronic kidney disease and the increase of mortality rate in patients with chronic kidney disease (CKD) and systemic hypertension (SHT). In spite of significant differences in reference ranges, the ACVIM consensus provides quite specific values of the systolic arterial pressure. Basing on them, one may include the patient in one of 4 groups in terms of the risk of Target Organ Damage (TOD):

- Group 1 - normal tension, minimum risk of TOD at SBP (systemic blood pressure) <140 mmHg
- Group 2 - low risk, SBP between 140 and 159 mmHg
- Group 3 - moderate risk, SBP between 160 and 179 mmHg
- Group 4 - high risk, SBP above 180 mmHg

Unfortunately, hypertension may induce polyuria (pressure diuresis) with a secondary decrease of urine specific gravity <1.030 which, however, does not always mean renal failure. The final diagnosis of pressure hypertension, being the only medical issue in a feline patient, requires additional diagnostic tests, including the ultrasound examination of the abdominal cavity, measurement of serum symmetrical dimethylarginine (SDMA) concentration, urinalysis with the measurement of urinary protein to creatinine ratio, as well as the measurement of serum thyroxin and cortisol concentration (in the case or cortisol and/or urine).

- arterial blood pressure should be performed in an isolated, quiet room, far from any stressors (inluding other animals), preferably in a company of the owner
- cat should be provided with a chance to adapt to the environment of a consultation room (5-10 mins of acclimatisation to the new place)
- measurement should preferrably be performed in lateral recumbency or in a prone position
- cuff size should be adjusted to the circumference of a leg or tail - it should be equal to about 30-40% of the circumference of the measurement site
- it should be attempted to aquire 5-7 repiteable results to draw an average value

Fig. 1. Protocol of the correct measurement of arterial pressure in small animals (according to ACVIM consensus, 2018).

Hypertensive encephalopathy

Most common clinical symptoms of hypertensive encephalopathy include: stupor, general behavioural disorders, ataxia, drowsiness, fever and/or seizures[8,9,10]. In one of the studies including patients with neurological symptoms associated with hypertension, systolic pressure varied between 160 mmHg and 300 mmHg. It proved that the issue was not limited exclusively to patients from group IV with the highest risk of TOD, but might have been present in one third or even half of the patients with hypertension[11, 2]. The mean age of cats with severe arterial hypertension and secondary neurological symptoms is about 16 years.

Ageing-related vascular lesions in the central nervous system are additionally likely to be involved in the pathogenesis of said disorder. In isolated cases, the abdominal neck flexion, paresis, pleurosthotonus (the Pisa syndrome), and cranial nerve paralysis were observed[9].

Additionally, cats may suffer from vestibular symptoms, head tilt, and nystagmus[3].

The proper diagnosis of hypertensive encephalopathy is made on the basis of medical history and after performing two subsequent measurements of arterial systolic pressure, which usually exceeds 160 mmHg. In particular, in geriatric patients, it is vital to exclude other CNS diseases which overlap with the described manifestation, including contagious, neoplastic, as well as degenerative diseases.

Using advanced imaging techniques is essential, especially taking into account the fact that a typical MRI image of hypertensive encephalopathy was described in 2013[12]. Said examination makes it possible to identify the foci of angioedema in lateral and occipital cerebral lobes.

Church et al. (2019) described lesions associated with hypertensive encephalopathy, which were observed during the necropsy of 12 cats. All the patients showed peracute clinical symptoms, which were results of the prosencephalon or brain stem damage[8]. The oedema of the caudal part of the brain and/or cerebellum were macroscopically visible whereas the microscopic examination showed bilateral, symmetrical oedema of the cerebral white matter, vascular lesions with arteriolar hyalinosis and hypetrophy[10]. Similar lesions were also described by other authors[13, 14]. Pathologies in CNS were usually associated with changes in the renal tubules and interstitial tissue, thyroid adenomas, uvea degeneration, and concentric left ventricular hypertrophy. Brown et al. (2005) additionally described the foci of microhaemorrhages and necrosis in the brain[10]. In advanced cases, intracranial haemorrhage may be observed[12].

Hypertensive retinopathy in cats

In general, ocular lesions with varied degree of advancement are observed in all the feline patients with arterial hypertension[3].

The most common cause of consulting a cat with hypertension is a sudden loss of vision[15]. In the majority of cases, apart from arterial hypertension (usually about 180 mmHg, although problems with eyes may also be identified at systolic pressure equal to 168 mmHg)[16], retinal detachment, haemorrhages, oedema, and optic nerve neuropathy secondary to ischaemia are observed[2]. Most of the patients usually show neurological disorders, but retinal lesions are found thanks to extended diagnostics, as the majority of pet owners is not able to recognize a low or moderate degree of vision loss[9].

Cases of hypertensive retinopathy secondary to adrenal tumour were also described[17]. In order to confirm the diagnosis, eye fundus examination must be performed by a veterinary ophthalmologist specializing in small animals. Vision problems which are secondary to hypertension may be associated not only with the most common exudative retinal detachment, but also - with the uvea damage i.e. hypertensive choroidopathy and optical never damage (neuropathy)[18,19]. Laboratory tests in patients with hypertension showed a statistically significant increase of cardiac troponins and VEGF concentration. Nevertheless, none of said biomarkers (including additionally natriuretic peptide, NT-proBNP) showed diagnostic value in cats with hypertensive retinopathy[20].

Long-term prognosis for recovery of vision in patients with hypertensive retinopathy depend to a great extent on the time of starting therapy after the episode of vision loss. The presence of menace response at the moment of diagnosis translates into a significantly higher probability of eyesight recovery, even if therapy is started more than 2 weeks after the episode of vision loss[21, 19]. Thanks to the proper pharmacotherapy of hypertension, it is possible to re-attach the damaged retina. However, the complete restoration of vision is possible only in a small percentage of feline patients[19].

According to the studies, a degree of kidney failure advancement is not a prognostic factor of the retinopathy development risk. Arterial hypertension in cats with renal failure is significantly lower than in patients with concurrent diseases, such as concentric left ventricular hypertrophy, hyperthyroidism, or primary hypertension[22].

A regular measurement of arterial pressure is recommended in cats above 10 years of age. They are considered high risk patients with predisposition to hypertension[2,23].

Detailed therapeutical recommendations for the management of canine and feline arterial hypertension were presented in the ACVIM3 consensus in 2018 (Table 1). A team of experienced cardiologists explicitly outlined the rules of hypertension and secondary pathologies management. In the literature of the subject, it is usually suggested to apply a therapy based on calcium canal blockers, in particular - on amlodipin[2] and angiotensin convertase inhibitors, enalapril[12] , or benazepril. Prognosis are usually good – the neurological symptoms secondary to hypertensive encephalopathy usually resolve after the pharmacological stabilization of hypertension[12].

Summary

Impaired mobility, seizures, and behavioural changes, which are often incorrectly interpreted as symptoms of dementia and typical behavioural patterns of "a geriatric" cat, should encourage veterinarians to extend diagnostics to cardiovascular diseases, in particular - severe arterial hypertension. Besides, cats with visual impairment secondary to hypertension should undergo a detailed diagnostics for concurrent chronic diseases, especially - renal failure, hyperthyroidism, diabetes, and heart diseases. It is essential to be able to provide such patients with a holistic medical and veterinary care. Although lesions in target organs are usually severe, some of them may be reversed with the help of a proper pharmacotherapy.

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Arterial hypertension pharmacotherapy

Active substance	Dose	Comments
Amlodipine	The initial dose: 0,625 mg/cat Every 24 hours	In the case of SBP > 200 mmHg, it is recommended to start therapy from 1.25 mg/cat SID, maximally up to 0.6 mg/kg SID;
Telmisartan	2-3 mg/kg Every 24 hours	Treatment of proteinuria; The drug efficacy was not studied in severe hypertension (>200 mmHg) or in the case of and hypertensive retino- or encephalopathy; A combination therapy with benazepril (ACEI) may result in a significant increase of creatinine and urea concentration in blood serum, which is not observed in the case of amlodipine3. Do not use in dehydrated cats
Benazepril	In CKD*: 0,5-1,0 mg/kg Every 24 hours In cats with a 50% heart insufficiency give the abovementioned doses	It is not recommended in monotherapy (low efficacy, the risk of glomerular filtration rate decrease, GFR); Do not use in dehydrated cats
Atenolol	6,25-12,5 mg/cat Every 12-24 hours Starting from lower doses and increase them if well tolerated	It is used in order to slow the rhythm in tachycardia in patients with hyperthyroidism; it is not recommended in monotherapy aimed at the reduction of blood arterial hypertension;
Spironolactone	2-3 mg/kg every 24 hours	Aldosterone antagonist In cats with hyperaldosteronism (in combination with amlodipine) together with the supplementation of potassium and underlying disease therapy: Adverse effects: facial dermatitis;

*CKD– chronic kidney failure

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Diagnostics and therapy of cats with hyperthyroidism and concurrent renal failure

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Abstract: Chronic renal failure is the most common disease associated with hyperthyroidism in cats. The coexistence of these diseases causes many diagnostic difficulties. Similarly, assessment of the course of hyperthyroidism treatment is not an easy undertaking. The ideal situation would be to bring the patient to the state of euthyroidism and, at the same time, improve kidney functioning. Unfortunately, in most cases it is very difficult or even impossible. Therefore, the goal should be to secure functioning and comfort of the animal in the course of both diseases.

Key word: hyperthyroidism, renal failure, cat

Introduction

At present, it is estimated that approximately 10-20% of all cats with diagnosed hyperthyroidism suffer from a chronic kidney disease (CKD) (Williams et al 2010). Nevertheless, diseases tend to mask each other, which hinders diagnosing and treating them.

A high concentration of T4 was believed to improve kidney functioning. However, it is now known that the best solution is to treat cats with hyperthyroidism and prevent iatrogenic hypothyroidism in said cases. Patients with coexisting diseases (not limited to a chronic kidney disease) should be treated in each case. Nevertheless, a careful monitoring of the patient's condition is required. In the case of a concurrent CKD, both treatment and monitoring of the patient will depend in the first place on advancement of the disease that is assessed according to the International Renal Interest Society (IRIS) guidelines, blood pressure, and the amount of proteins in the urine. The evaluation of the patient's condition, if combined with the measurement of the relevant laboratory parameters, is an easy and quite reliable method of therapy assessment.

Latent CKD with a clinical form of hyperthyroidism

It should be remembered that a high concentration of thyroid hormones may impede the interpretation of blood chemistry test and urinalysis results. In hyperthyroidism, glomerular filtration rate is increased. It is caused by a few factors, which are as follows:

- increase of the cardiac output – positive chronotropic effect;
- increase of the volume of circulating blood – activation of renin-angiotensin-aldosterone system (RAAS);
- reduction of systemic vascular resistance;
- increase of renal blood flow;
- increase of GFR;
- increase of renal sodium reuptake;
- increase of blood pressure.

Table 1. It proves that the prior described parameters cannot be used as reliable indicators of CKD

Serum creatinine concentration	decrease
Serum urea concentration	increase
Serum SDMA concentration	increase
Serum cystatin C concentration	increase
Serum phosphates concentration	increase
Plasma ionized calcium concentration	decrease, hypocalcaemia

The aforementioned factors mask the chronic kidney disease, so kidney function should be assessed only in the state of euthyroidism, meaning - after the stabilization of hyperthyroidism. The impact of hyperthyroidism on blood chemical parameters is shown in Table 1. It proves that the prior described parameters cannot be used as reliable indicators of CKD.

Having said that, how does hyperthyroidism affect the urinalysis results? Specific gravity value keeps fluctuating. In some cats it may be decreased or normal, while at the same time being increased in others. Therefore, it is not a reliable parameter that would confirm or exclude a chronic kidney disease (Williams et al. 2010). It is estimated that proteinuria with an increased urine protein to creatinine ratio occurs in 64-68% of cats with hyperthyroidism (Van Hoek et al. 2009). It is also reported in cats with CKD. Therefore, it does not serve as a reliable indicator. Furthermore, it is also necessary to exclude pre- and post-renal causes of proteinuria.

Hypertension, defined as a systolic blood pressure > 160 mmHg (Stiles et al. 1994), develops in about 20% of cats with hyperthyroidism. It should be,

Most common symptoms of hyperthyroidism in cats.

- Body weight loss
- Polyuria
- Polydipsia
- Polyphagia
- Excessive vocalization
- Tachycardia
- Vomiting, diarrhoea
- Apathy

Tab.2. Monitoring of hyperthyroidism*

Improvement of physical condition	• increase of body weight • improvement of BCS • improvement of the coat quality • elimination of tachycardia
Measurement of serum T4 level	• cats without CKD - it should be attempted to reach the concentration of 12.9-32-3 nmol/l
CBC	• monitoring of red and white blood cells
Renal parameters	• urea • creatinine • concentration of phosphorus • concentration of potassium
Serum fT4 measurement	• equilibrium dialysis method
Serum TSH measurement	• additional method which is particularly useful in the case of modification of antithyroid drug doses
Cardiological examination	• regular blood pressure measurement • echocardiography
Urinalysis	• specific urine gravity • bacteria culture

*According to 2016 AAFP Guidelines for the Management of Feline Hyperthyroidism (2016).

however, remembered that it does not have to be the outcome of the disease, but rather - be induced by stress. It seems that its effect is particularly visible in cats with hyperthyroidism. Besides, no difference in hypertension prevalence was observed between cats with hyperthyroidism and CKD and without it (Sye et al. 2002).

Are there any reliable parameters allowing to predict the development of CKD in a cat with hyperthyroidism? Unfortunately, there are no conclusive pieces of evidence pertaining to said matter. There are some useful parameters, such as the concentration of creatinine before the thyroid treatment. If it is within the upper range limit, then CKD is likely to develop. The same applies to SDMA, but its specificity is 33% (Williams et al. 2010). Other parameters which are measured to assess renal function efficiency seem to be completely useless. Therefore, there is no test which could provide an answer to the formulated question.

Treatment of hyperthyroidism with a concurrent CKD

The first matter that needs to be remembered is the regular control of serum creatinine concentration, urine specific gravity, as well as blood pressure. Overt form of renal failure may develop a few months before achieving the stability of serum thyroxine concentration.

The protocol of CKD management in cats with CKD and concurrent hyperthyroidism is presented in Figure 1, whereas Figure 2 shows management in a reversed situation.

In cats with CKD diagnosed together with hyperthyroidism, it should be attempted to stabilize thyroxine concentration within the lower half of the limit. In the case of an advanced CKD, therapy with antithyroid drugs should be started very slowly with the lowest dose given once per day (e.g. metamizole 1.25 mg/cat SID). In the case of the increase of serum creatinine > 5 mg/dL, the dose should be immediately reduced. It is also necessary to introduce a renal diet at the very beginning of therapy. Nevertheless, forecasts for such patients are poor and the overall survival is 6 to 24 months (Milner et al. 2006).

In animals which develop azotaemia during therapy, the protocol of kidney and thyroid monitoring is identical. Nevertheless, it has already been mentioned that azotaemia may develop even after 3 months of antithyroid therapy. It affects about 15-25% of patients (Paterson et al. 2018). Further management depends on the clinical condition of the cat and results of T4 measurement tests, just as shown in Figure 3.

Summary

A brief summary of the most important conclusions of this article:

- all cats with hyperthyroidism should be treated;
- theory of a positive impact of „mild hyperthyroidism" on the kidneys was proved wrong;
- induction of hypothyroidism should be avoided in cats;
- treatment should be started with pharmacotherapy and diet;
- only regular blood tests, urinalysis, and measurements of blood pressure in a combination with the assessment of BCS allow for the successful treatment of patients.

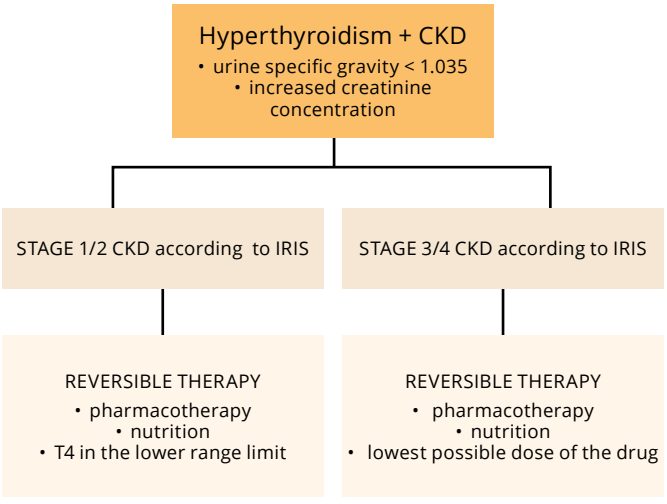

Figure 1. Management of hyperthyroidism in a cat with CKD

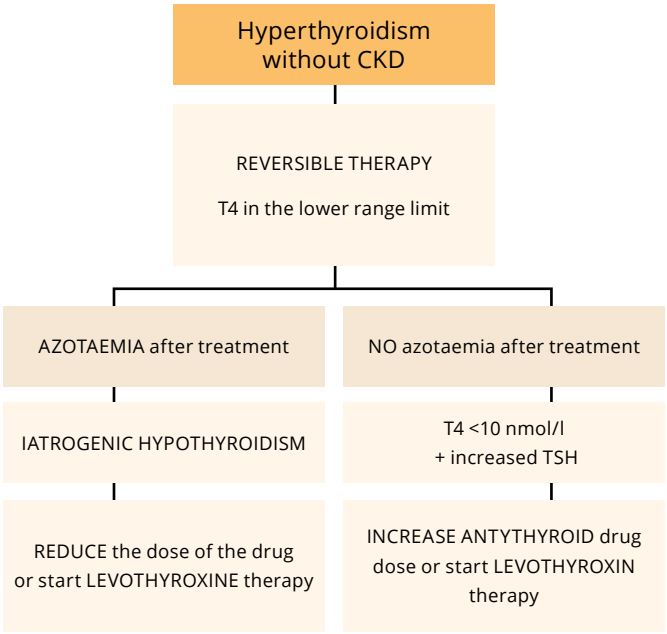

Fig 2. Management of hyperthyroidism in a cat without CKD

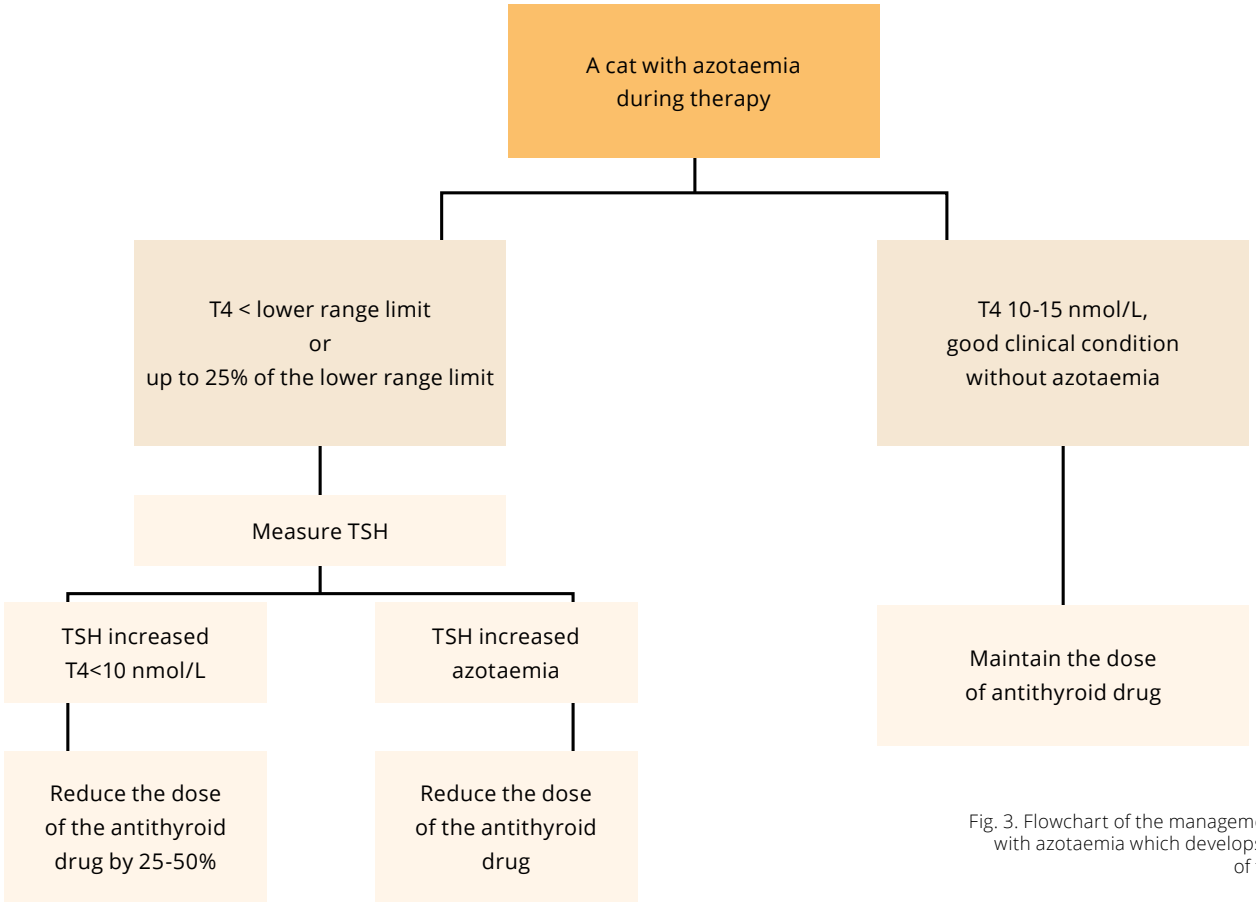

Fig. 3. Flowchart of the management of patients with azotaemia which develops in the course of the treatment.

The author's comment:

I highly recommend the readers to familiarize themselves with the currently applicable recommendations of diagnostics and management of feline hyperthyroidism in cats:

- 2016 AAFP Guidelines for the Management of Feline Hyperthyroidism Journal of Feline Medicine and Surgery (2016) 18, 400–416.
- ISFM Consensus Guidelines on the Diagnosis and Management of Feline Chronic Kidney Disease Journal of Feline Medicine and Surgery (2016) 18, 219–239.

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Feline cardiomyopathy – what should be taken into account?

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Abstract: Feline cardiomyopathy is the most common heart disease when it comes to this species. The prevalence of hypertrophic cardiomyopathy in the general population of cats is about 15% and in the predisposed breeds - even 30%. Feline cardiomyopathy is a heterogenous, progressive disease which leads to heart failure and often to death. Due to the lack of causative treatment and effective therapies, the primary objective is to diagnose the disease and exclude sick animals from breeding.
Key words: heart, cat, feline cardiomyopathy, diagnostics.

Introduction

Feline cardiomyopathy is a heterogenous group of primary heart diseases of partially unknown aetiology which causes the dysfunction of said organ[1]. A few phenotypes of feline cardiomyopathy are distinguished according to the current classification:

- phenotype of hypertrophic cardiomyopathy (HCM), including a genetic form (the most common one)
- dilated cardiomyopathy phenotype (DCM)
- restrictive cardiomyopathy (RCM) phenotype in two forms: myocardial and endomyocardial
- arrhythmogenic right ventricular cardiomyopathy (ARVC)
- unspecific cardiomyopathy (UCM)

Hypertrophic cardiomyopathy

Hypertrophic cardiomyopathy, both in the genetic form and without a confirmed underlying genetic cause, is defined as a hypertrophy (thickening) of the walls mainly of the left ventricle and papillary muscles, as well as the reduction of the left ventricular lumen (concentric hypertrophy). It is important to exclude other diseases which may cause cardiac hypertrophy, including: arterial hypertension, thyroid hypertrophy, acromegaly, and neoplastic infiltrates (especially in feline leukaemia)[1, 10]. Hypertrophic lesions in a given cat may be mild, moderate, or severe and they are diagnosed during echocardiographic examination. The disease may become visible at any age and its prevalence increases with age. It is estimated that its prevalence is 9-15% of the general population of cats and up to 30% among Maine Coon and Ragdoll cats. In the majority of cases, the aetiology of HCM remains unknown (idiopathic). The first hereditary form of HCM was described in 1999 in Maine Coon cats. Nevertheless, a genetic background remains unknown. Three mutations linked to the development of HCM were identified and two of them were associated with binding C protein gene. The first mutation in MYBPC (A31P) gene was described in Maine Coon cats in 2005[9] and the second mutation in the same gene (MyBPC-3-R820W) was detected and described in Ragdoll cats in 2007[10]. The third mutation was reported in 2021 in sphinx cats and was associated with ALMS1 gene[14]. In spite of many efforts of research teams from all over the world, other mutations leading to the development of HCM in cats were not identified. It does not, however, exclude the genetic cause of the discussed disease. Males become sick more often than females. A particularly significant difference was identified in British shorthair cats, where HCM was diagnosed in 20.4% of males and in 2.1% of females. The following breeds are believed to be the most predisposed to the disease: Maine Coon, Ragdoll, Norwegian forest cat, Siberian, British shorthair and longhair, sphinx, Devon rex, and German rex[2]. As of currently, there are analyses of other serum parameters performed to find out if they can help to determine the risk of HCM development in specific cats. It is particularly important from the breeding perspective, since this disease is hereditary in many cases. Genetic tests for MyBPC3-A31P and MyBPC3-R820W mutations are (respectively) recommended in Maine Coon and Ragdoll cats used for breeding (the level of evidence [LOE] is high) in order to reduce the prevalence of said mutations and HCM in the discussed breeds. It is recommended that cats homozygous for the aforementioned mutation are not used for breeding. Cats heterozygous for this mutation, if they show outstanding features, may be used for breeding provided that they are crossed with negative genotype felines (low LOE)[15]. Many research teams have been looking for other parameters which would be easy to measure and helpful with regard to identifying cats having a higher risk of HCM development. There are high expectations related to the measurement of microRNA, which was proved to be a valuable diagnostic parameter in individuals with heart diseases. The concentration of 6 types of microRNA was evaluated in cats, but initial test results did not allow to make it applicable for diagnostics of HCM and to replace echocardiographic examination. Echocardiography is still treated as a gold standard for diagnosing said disease and other phenotypes of feline cardiomyopathy[11]. It should be remembered that HCM is a heterogenous feline disease with various levels of symptom severity. Some sick cats show symptoms of a congestive heart disease (CHF), while symptoms of arterial thromboembolism (ATE) are observed in a high percentage of cats (Figure 1). A sudden death may also happen in the discussed group of cats[4, 11]. In some cases, in spite of left ventricular hypertrophy, a long survival period is reported and no symptoms of heart disease are visible for many months.

Fig.1. Cat with ATE episode

Clinical symptoms and diagnosis

One of the initial symptoms observed in a significant percentage of cats with HCM is systolic murmur in the clinical examination. This murmur is related to dynamic left ventricular outflow tract obstruction (DLVOTO). It results from an abnormal movement of the mitral valve leaflet towards the interventricular septum (systolic anterior motion, SAM). Dynamic aorta narrowing causes the acceleration of blood flow and turbulence, which is visible in the colour Doppler echocardiography. This phenomenon is often associated with the mitral valve regurgitation. Yet another detectable symptom in cats with cardiomyopathy is the presence of additional heart sounds (gallop). Symptoms of heart failure (accelerated respiration, dyspnoea, pulmonary oedema, or the presence of liquid in the body cavities and pericardium) are associated with left ventricular systolic insufficiency. Atrial enlargement (especially of the left atrium) is caused by a chronic increase of ventricular pressure of one or both ventricles. Arrythmias, in particular premature ventricular contractions or systolic tachycardia, may be observed in cats with HCM. Tachycardia may progress to ventricular fibrillation and cause death. Heart rhythm disorders are caused by the reduction of coronary flow by a significantly hypertrophic heart, which causes ischaemia, cellular apoptosis, as well as the fibrosis of myocardium. Arterial thromboembolism is the result of the separation of thrombi forming in the left enlarged atrium (especially in the appendage). It causes the occlusion of arterial vessels and ATE symptoms in the form of limb paralysis. The vessel occlusion is usually caused by the so-called saddle embolus in the abdominal aortic bifurcation[4]. A sudden and complete occlusion of the vessels supplying blood to the pelvic limbs leads predominantly to severe pain (in particular - in peripheral parts of the limbs), pale claw wall and paws, lower temperature in the peripheral segments of the pelvic limbs, changes in the perception of extremities, lack of pulse or significant reduction of the pulse on the femoral arteries, paresis, as well as paralysis. Episodes of ATE are in many cases the cause of animal euthanasia.

Echocardiographic examination remains the most efficient diagnostic method in the case of cardiomyopathy and it is recommended to perform prophylactic examinations every 12-24 months, especially when it comes to the predisposed cat breeds (Fig. 2).

Diagnosis

After making a diagnosis of HCM in a cat, many owners want to hear from a vet about the prognosis and survival time. A group led by Virginia Luis Fuentes tested 282 cats in order to define the usefulness of clinical and echocardiographic parameters in the determination of prognosis. Among the independent factors significantly contributing to the increase of the risk of a cat's cardiac death, there are the reduction of systolic left atrial function (LA-FS%), reduction of systolic left ventricular function (FS) below 30%, and a significant hypertrophy equal to or higher than 9.0 mm[11]. Other factors contributing to a significant risk of a cat's cardiac death in case of HCM phenotype are presented in Table 1.

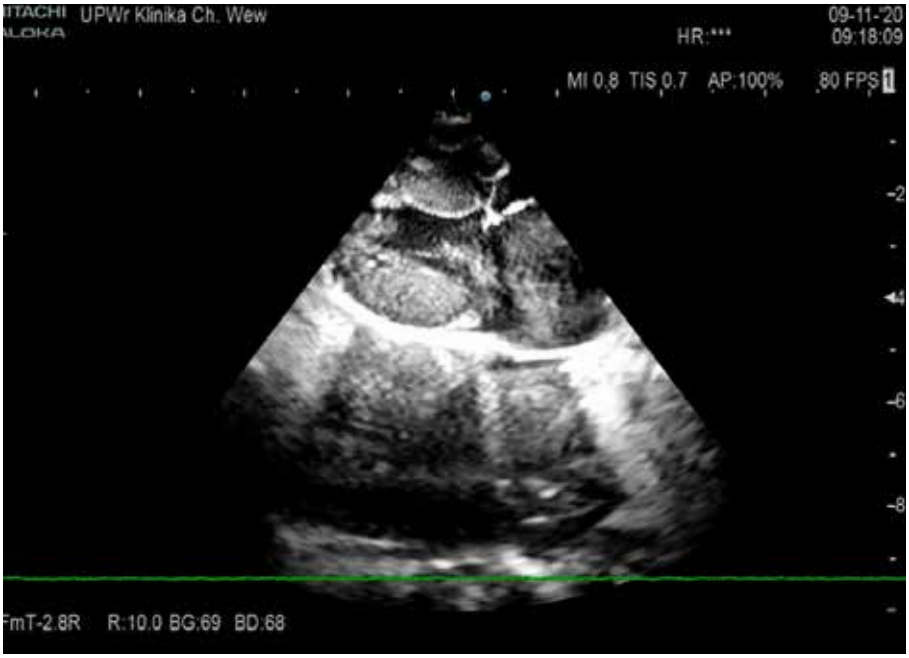

Fig.2. Echocardiographic image of a cat with the HCM phenotype, visible concentric left ventricular hypertrophy, left atrial dilatation and the presence of spontaneous echocontrast in the left atrium.

Screening tests in cats are very important, since the therapy of hypertrophic cardiomyopathy is difficult and symptomatic. In the case of dyspnoea, the measurement of NT-proBNP in plasma/serum or pleural liquid allows to differentiate dyspnoea associated with heart failure in cats from the one caused by other causes[15].

Other phenotypes

Other forms of feline cardiomyopathy occur more rarely than HCP phenotypes. Echocardiography

Table 1. Factors contributing to the increased death risk of cardiac death in cats with hypertrophic cardiomyopathy[11]

PARAMETR	Increased death risk (HR – hazard ratio)
Age (each year of life)	1,07
Murmur in clinical examination	0,34
Additional heart sounds (III, IV) in clinical examination	1,77
Arrhythmia in clinical examination	3,25
Arrythmia in ECG	2,38
Thromboembolic event (ATE)	6,36
Congestive heart failure	6,74
Significant left ventricular hypertrophy (≤9.0 mm)	3,31
Reduced systolic function of the left ventricle (FS ≤30%)	6,59
Regional left ventricular hypokinesis	6,45
LAD 16.1-21.0 mm	2,58
LAD≥21.1 mm	10,73
Reduction of left atrial systolic function (LA-FS≤30%)	9,72
Reduction of LA-FS by each 1%	0,87
Thrombus in the left atrium	7,33
Reduction of blood flow in the left atrial appendage (LAA≤0.26 m/s)	3,91
SAM	0,48
Restrictive mitral inflow pattern	3,08

LAD- left atrium diameter, LAA- left atrial auricle

is the recommended form of diagnostics in all cases. A typical feature of RCM phenotype is a significant dilation of the left atrium with no concentric left ventricular hypertrophy. Endomyocardial form of RCM is characterised by macroscopically visible „connective tissue bridges" which usually connect the ventricular septum and the left ventricular free wall. Sometimes an aneurysm of the left ventricular wall apex is observed, lumen of the left ventricle may be correct or slightly dilated. In the case of a myocardial variant, the dimension of the left ventricle may be normal, but it may be accompanied by an enlargement of the left atrium or both atria. When it comes to the DCM phenotype, it is characterised by the reduction of the left ventricular systolic function and a progressing increase of the size of the left ventricular lumen with normal or reduced thickness of its wall. Atrial dilation is observed. In the case of ARCV phenotype, a significant dilation of the right atrium and the right ventricle with right ventricular systolic dysfunction is observed. Arrhythmias and right-sided congestive heart failure symptoms are observed. In the case of a phenotype which is not consistent with any of the above descriptions, unspecific cardiomyopathy is diagnosed.

It should be kept in mind that the aetiology of feline cardiomyopathy is still not completely understood. This disease is difficult to diagnose and treat. What is more, it is connected with poor prognosis in a large number of cats and that is why the prophylactic examination of cats is so important.

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Diabetes in cats – an existing problem in veterinary medicine

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Abstract: The article elaborates on a contemporary issue of diabetes in cats. The author briefly discusses diagnostics and describes treatment, in the case of which a properly balanced diet plays a crucial role. Furthermore, the author characterizes types of insulin and viable methods of monitoring blood glucose concentration.

Key words: diabetes, cats.

Introduction

Diabetes mellitus (DM) is a metabolic disease that is strictly associated with the inability of the organism to maintain a proper blood glucose concentration. It may be a result of the loss or dysfunction of pancreas beta cells, as well as of the reduction of peripheral tissue insulin susceptibility. On some occasions, the aforementioned two matters may turn out to be underlying causes at the same time. Permanent hyperglycaemia and glucosuria are the most prevalent symptoms of diabetes.

According to WHO, in human medicine, three types of diabetes can be distinguished. They are as follows: diabetes type 1, diabetes type 2 and diabetes type 3 (the so-called secondary one), as well as diabetes diagnosed in pregnant women (the so-called gestational diabetes). When it comes to cats, diabetes type 2, i.e. insulin-dependent diabetes, is the most common variant. In very few cases, diabetes type 1 that is associated with autoimmune disorder develops. It is related to the antibody-induced destruction of pancreatic islets. While taking into account diabetes type 2, peripheral insulin resistance is observed. It is most commonly associated with obesity, which results from imbalance between the amount of calories taken in and burnt. It usually occurs when a daily ration is not controlled and a particular cat eats too much. The reason for such a state of affairs is usually an increased appetite which is observed in castrated animals and is likely the result of a prolonged stress ("compulsive eating"). There may be numerous other causes of insulin-resistance. They include, inter alia: an elevated concentration of growth hormone, cortisol, as well as the use of exogenous steroids and (endo- or exogenous) progesterone. It hinders glucose penetration into the cells, which in turn leads to hyperglycaemia stimulating the release of insulin. In the case of diabetes, the so-called glucose toxicity may be observed, which results in the inhibition of insulin release. Said phenomenon results, among others, from: the nonenzymatic glycosylation of extra- and intracellular proteins, accumulation of sorbitol (in the aldose reductase pathway), activation of kinase C isoform protein, reduction of nitrogen oxide production, and generation of free oxygen radicals.

Morbidity, clinical symptoms, diagnostics

Diabetes mellitus is usually observed in obese, medium-aged, older (senior), or geriatric cats. Males show predisposition to and are affected by diabetes to a remarkably greater extent than females. According to the available literature, Burmese cats are extremely predisposed to the aforementioned disorder. A medical history provided by the cat owner can help reveal information on polydipsia (PD) and the frequency of urination (polyuria, PU). Polyphagia (PP) i.e. an increased appetite, may also be observed. It leads to the body weight increase. Nevertheless, in some cats, long-lasting, untreated diabetes leads to the excessive mobilization of fat, fatty liver syndrome, hypercholesterolaemia, hypertriglyceridemia, as well as in the intensification of catabolic processes resulting in body weight loss. In some cats, weakness of pelvic limbs and plantigrade stance may be observed. Said symptoms are consequences of progressing peripheral neuropathy and impaired circulation. Healing of injured areas of previously inflicted wounds may be hindered or there may be an increased risk of secondary bacterial infections associated with changes in microcirculation. In contrast to dogs, cats usually do not develop a diabetic cataract. Nevertheless, individual cases are described in the available literature on the subject[6]. The author of this publication also treated a cat which developed a diabetic cataract in a short period of time. Other potential causes were eliminated. It may also happen that a cat shows fluctuations or a complete lack of appetite, diarrhea and/or vomiting resulting from complications caused by the underlying disease e.g. by a concurrent pancreatitis, which is often diagnosed in diabetic cats and leads to pancreatic cell damaging[3, 5, 6].

The laboratory-oriented diagnostics of diabetes includes blood tests (CBC or blood chemistry) and urinalysis with a microbiological culture. When it comes to straightforward cases, no CBC abnormalities are observed. Signs of increased blood density (elevated values of parameters associated with erythrocytes, haemoglobin, or haematocrit) are observed only with regard to dehydration and leucocytosis with neutropenia. Granulocytosis are found in the case of concomitant pancreatitis. The blood chemistry test shows hyperglycaemia. Nevertheless, when diabetes is suspected, it should be differentiated from stress-related hyperglycaemia. Therefore, it is recommended to measure fructosamine concentration at the same time. Said parameter allows to identify glycaemia lasting for over 2 weeks and excludes the impact of stress on blood glucose concentration. In some cases, the increase of hepatic transaminases is also observed and if a concurrent pancreatitis is present, specific pancreatic lipase fPLI level becomes elevated as well. In senior cats, blood urea concentration (prerenal uraemia) caused by vomiting, concomitant haemorrhagic gastritis, and/or enteritits may be identified. Urinalysis always shows glucosuria, which is associated with the elevated urine specific gravity. In cats, a glucose renal threshold is higher than in dogs. What is more, glucose is excreted with urine when its serum concentration exceeds 200-288 mg/dL (11–16 mmol/L[2]. Since glucosuria increases the susceptibility to secondary bacterial infections of the urine bladder, even when active urine sediment is absent, an in-depth microbiological examination should be performed. Urine sample is collected by cystocentesis. Diseases associated with polydipsia, polyuria, body weight loss or gain, polyphagia, as well as fluctuating appetite should be excluded in differential diagnostics. It should also include: stress-induced hyperglycaemia, hepatic and renal diseases, and gastrointestinal disorders - including inflammation or exocrine pancreatic insufficiency. It is paramount to exclude parasitic diseases and cystitis as well. Ketone bodies (ketonuria) may appear in the urine of a cat in

poor clinical conditions. If apart from ketonuria, ketonemia (high blood concentration of ketone bodies) is also observed in diabetes, the so-called diabetic ketoacidosis (DKA) may be suspected. It is mainly manifested by: vomiting, apathy, dehydration, or even shock. Diabetic ketoacidosis, which develops in diabetes, may be caused by concurrent diseases causing insulin resistance, e.g. pancreatitis or steroid therapy, as well as bacterial infections[5]. It is vital to differentiate DKA and ketosis, which is not accompanied by acidosis but rather by ketonuria or ketonemia and cats seem to be in a proper condition.

Therapy. Types of insulin, glycaemic control

The treatment of diabetes type 2 in cats requires, at least in the preliminary period, the administration of exogenous insulin. Porcine lente insulin (Caninsulin) is usually administered. Said product is authorised for treatment of diabetes mellitus in dogs. It starts to work within 30 to 60 minutes from the moment of administration and its peak efficiency is observed after 2 to 8 hours from the moment of injection. Its efficiency timeframe oscillates between 6 and 14 hours. Lente insulin, like in the case of dogs, should be administered twice a day. The initial dosage of insulin is 0.25 IU/kg b.w, and is administered subcutaneously. In practice, 1 IU/cat is given to cat of an average body weight of 4 kg. Glycaemia should be controlled after 6-8 hours from the moment of administration of the first dose of insulin in order to confirm it is correct and exclude the risk of hypoglycaemia. At the same time, the cat owner should be informed that in the case of weakness, apathy, excessive salivation, muscle tremors, seizures, or disturbed consciousness he or she has to give the cat glucose, honey, or even water with sugar orally. Said approach allows to balance hypoglycaemia, which is life threatening and may lead to diabetic coma. Therefore, it is paramount to administer precise doses of insulin which may increases therapy safety. That is why pet owners should use pens instead of insulin syringes. Doses of Caninsulin should be increased not earlier that after 5-7 days from the previous modification, mainly due to the fact that the full efficiency is observed after a specific time and excessively high doses may cause Somogyi (a rebound) effect. It is a recurrent hyperglycaemia resulting from insulin overdose. If insulin dose elevation does not lead to a desired effect, a different product should be opted for.

Protamine zinc insulin (PZI) or human insulin analogue – glargine may also be used in cats. It starts to become efficient after 1 to 4 hours from the moment of its administration, whereas the peak efficiency is observed between 3 and 14 hours. Its effect lasts from 12 to 24 hours. Said insulin is slowly released from the site of subcutaneous administration. The initial dose is 0.5 IU / kg b.w. twice a day. In some cases, one dose daily is administered and it is well tolerated. A viable alternative is Detemir, yet another long-lasting insulin. It is dosed in the same way as glargine. It is not, however, recommended as a "first line" insulin due to its long-lasting efficiency (>24 h) and higher risk of hypoglycaemia, as opposed to the previously described insulin. NHP insulin or oral antidiabetic drugs (e.g. glipizide)[4] are not recommended in cats[4].

The supervision of glucose therapy requires monitoring of blood glucose concentration. It should be performed randomly within the first 24 to 48 hours after changing the dose. A cat owner may measure blood glucose concentration on his or her own with veterinary glucometers which are widely available (Fig. 1). A typical spot of blood collection for tests is auricular vein (Fig. 2). Measurement of sugar at home is more comfortable and less stressful for a cat, especially in comparison to a consultation room, which may in turn affect blood test results.

Over the previous years, a new solution has been applied. It is a continuous interstitial glucose monitoring. Nevertheless, it requires the placement of catheter (sensor) under the skin. Its mode of operation is based on the use of glucose oxidase involved in enzymatic reaction, which is converted into measurable electric signal. It has been shown that the concentration of glucose in the interstitial fluid is to a remarkable extent correlated with its blood level. It should be remembered though that there is a 5 to 12-minute lag between changes in blood and the interstitial fluid glucose concentration[3]. The device which is validated to use in cats (iPro2, Medtronics) collects ISF samples for measurements every few seconds. An external sensor records said values every five minutes. The readings are translated into 288 recordings within a day. The most remarkable advantage of the aforementioned method is the collection of a great number of measurements obtained within 3 to 5 days from one patient at home. A significant disadvantage is the necessity to perform at least two readings of blood glucose concentration with a glucometer in order to calibrate the device, as well as a limited scope of a measurement range i.e. from 40 to 400 mg/dL.

Diet

The proper treatment of diabetes also requires a viable dietary management in order to optimize body weight, which in turn improves glycaemic control. It refers mainly to obese and overweight cats, since excessive fat tissue contributes to insulin resistance. Choosing the right diet and correctly determining the ration are fundamental. A diabetic cat should be on a high-protein diet, which means that 40% of metabolic energy should be provided from proteins. It allows to maximize the pace of metabolism without the loss of lean body mass. At the same, the risk of hepatic steatosis becomes limited. Proteins normalize fat metabolism, improve food palatability, as well as intensify the feeling of satiation. It is an essential metabolic ingredient for absolute carnivores, for it is the source of raw material for production of endogenous proteins, enzymes, hormones etc. Besides, it provides an obese diabetic cat with a low calorie source of energy, which may or even should be eaten in a respectively higher quantity.

Fig 1. The Vet Expert veterinary glucometer allowing for controlling blood glucose concentration.

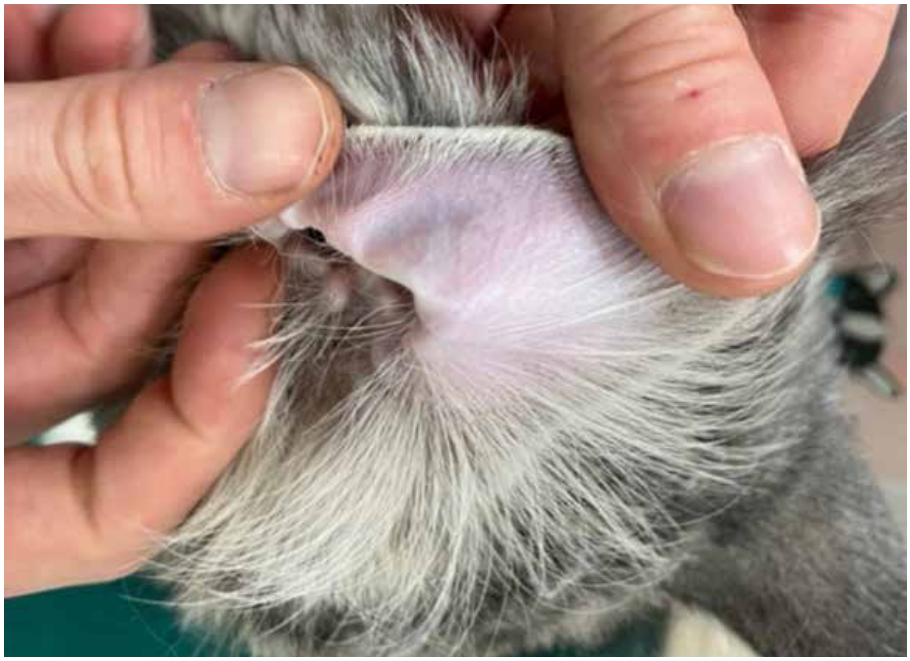

Fig. 2. A site on the ear from which a blood droplet may be collected by an owner in order to perform measurements at home

Fig. 3 Collection of a blood sample for laboratory analyses during a follow-up visit.

At the same time, arginine is worth mentioning, because it stimulates insulin secretion (7).

The reduction of calories in a sick cat's diet should be based on the decrease of the content of fats and carbohydrates. The reduction of carbohydrates results, however, from the necessity to avoid exacerbation, maintain hyperglycaemia, and reduce the risk of "glucose intoxication". Therefore, according to the most recent recommendations of AAHA from 2018, a metabolic energy obtained from said component of diet should account for about 12% (1).

In practice, diets with a high content of proteins and low (or moderate) content of fat and carbohydrates are wet products. The increased content of water in diet additionally allows for better hydration of the cat's body. It has also been shown that the use of high-protein and low-carbohydrate diet, in a combination with insulin, contributes to remission of this disease in 15 to 100% (4,5). The highest remission rates have been recorded when a long-acting insulin: glargine (Lantus) and detemir (Levemir) have been used in newly--diagnosed patients (glargine) and within the first 6 months from the diagnosis (both forms of insulin) (1). It also should be noted that diets characterized by a higher concentration of fiber have not led to achieving a desired disease control. Therefore, at present they are not recommended.

The determination of ration is based on the correct estimation of a daily energy requirement. It should be based on the so-called lean body mass (LMB) and a formula based on metabolic body weight measured in kilos to a power of 0.64 (for overweight and obese cats) or 0.67 (for cats with optimal body weight). Since a diabetic cat is obese or overweight, the initial DER value is equal to Resting Energy Requirement (RER). After the conversion of DER, a daily ration of the recommended diet should be determined and then properly adjusted. For body weight measurements, the same scale should always be used. A cat should be weighted at least once or twice a month and the Body Condition Score (BCS) should be also assessed. If overweight or obese, a cat should lose 0.5-2% of its body weight per week. Nevertheless, even lower values are preferred.

It is also vital not to restrict the number of meals, as a cat is an animal which tends to eat a little and often. A relatively stable intake of high protein food enables for the constant production of energy from proteins in the liver. Said fact ensures the proper metabolic stability and the possibility of maintaining a proper body weight or even recovering it in the case of underweight cats. It also should be emphasized that the same method of feeding may be applied in overweight cats. Nevertheless, it should be remembered that a daily ration of calories should not be exceeded.

To summarize, it should be mentioned that although the diagnostics of diabetes may be relatively simple, therapy and glucose monitoring may turn out to be quite difficult and challenging for a clinician.

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Triaditis in cats – the aetiology and management

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Abstract: The "triaditis" term refers to the simultaneous presence of idiopathic enteritis (IBD), cholangitis, and pancreatitis in cats. In felines with triaditis, clinical symptoms are not very specific and their type depends on the severity of the inflammatory process developing in a given organ. The most common clinical signs of said disease are as follows: lowered or lack of appetite, significant weight loss, various types of vomiting and/or diarrhoea, as well as jaundice. This paper provides a description of the aetiology, diagnosis and treatment of triaditis in cats.

Key words: triaditis, cat, diagnosis, treatment

Introduction

„Triaditis" refers to a concurrent presence of three diseases: pancreatitis, cholangiohepatitis, and inflammatory bowel disease (IBD)[1, 2]. Nevertheless, it is troublesome to determine which of them is an initiating disorder in animal with triaditis.

In clinical practice, the inflammation of a single organ is quite often diagnosed. However, it is uncommon to identify pancreatitis, cholangiohepatitis, and inflammatory bowel disease at the same time. It should be noted though that triaditis is more frequently diagnosed upon necropsy of cats. Swift et al. pointed out that triaditis was present in 50-56% of cats with diagnosed pancreatitis and in 32-50% of cats with diagnosed cholangiohepatitis[3]. It has to be also emphasized that due to a complex aetiology and a wide range of clinical symptoms, triaditis is difficult to manage, mainly because of the lack of a single therapeutic protocol.

Aetiology

A concurrent development of pancreatitis, cholangiohepatitis, and inflammatory bowel disease may be the consequence of a disorder of one organ, as well as the impairment of the function of all of them may be caused by one mechanism. Potential causes of triaditis include: bacterial infection, disorders of the immune system, and idiopathic causes.

One of theories behind the development of triaditis in cats is the so-called „bacterial translocation theory". It is associated with the anatomical structure of said species. In cats, the pancreatic duct and the common bile duct are connected with each other and open into the duodenal papilla through one opening. It enables for the translocation of duodenal bacteria simultaneously into the pancreatic duct and the common bile duct. The consequence may be the concurrent development of inflammation of the pancreas and the biliary tract.

According to this theory, an initiating agent of triaditis is inflammatory bowel disease (usually in the form of a lymphoplasmacytic inflammation). It should be remembered that it may also be caused by other diseases, such as small cell lymphoma or dysbiosis[4, 5, 8, 12]. Cats are predisposed to bacterial translocation because they have 100 times higher concentration of bacteria in the duodenum than dogs, which in turn increases the risk of triaditis. Besides, the most common clinical symptom in cats with inflammatory bowel disease is vomiting, which increases pressure in the duodenum and aggravates the reflux of the intestinal content into the bile or pancreatic duct. The most commonly isolated hepatic bacteria in cats with cholangitis include: Escherichia coli, Enterococcus spp., Bacteroides spp., Streptococcus spp., Clostridium spp., and Salmonella spp.[2-6]. In the case of cats with acute or chronic pancreatitis, the most frequently isolated bacteria include: E. coli, Streptococcus spp., and Enterococcus spp. Said bacteria reside in the intestines, which directly translates into the theory suggesting "bacterial translocation from the intestines" as aetiology of triaditis being probable.

The second theory behind the development of triaditis in cats points to immune-mediated disorder being the cause. Due to the frequent prevalence of lymphocytic pancreatis, lymphocytic cholangiohepatitis, and lymphoplasmacytic enteritis, it is presumed that triaditis is the consequence of some immune-mediated disorder. The enhanced reaction of the immune system may be the consequence of the immune response against bacterial allergens, food allergens, or autoimmune reaction. What confirms this theory is the fact that the clinical condition of animals improves after immunosuppressive therapy[7].

The above theories are most common explanations of the aetiology of triaditis in cats. Nevertheless, other underlying factors cannot be excluded.

Diagnostics

Clinical symptoms in cats with triaditis are unspecific and highly depend on the severity of the inflammation of the particular organ. It should be noted though that clinical symptoms associated with inflammatory bowel disease are most dominating ones.

Most common clinical symptoms of the discussed disorder include reduction or lack appetite, significant loss of body weight, various types of vomiting and/or diarrhoea, as well as jaundice.

Clinical examination of animals with triaditis may in some cases additionally reveal: yellowing of the mucous membranes, abdominal enlargement (which may be secondary to ascites or hepatomegaly), hypothermia, and fever.

In CBC anaemia, neutrophilia, neutropenia, or thrombocytopaenia may be diagnosed. Blood chemistry test results depend on the type of the organ with inflammation:

- in the case of cholangiohepatitis: elevated hepatic enzymes activity (alanine aminotransferase, ALT, asparagine aminotransferase, AST, gamma-glutamyl transferase, alkaline phosphatase) and increased total bilirubin concentration are identified. It should be noted that a slight increase of hepatic enzymes activity may be observed when it comes to pancreatitis and inflammatory bowel disease as well:
- in the case of pancreatitis, the activity of DGGR and specific feline pancreatic lipase (fPLI) is elevated;
- in the case of inflammatory bowel disease, the reduction of cobalamin, folic acid, albumins, total protein, and cholesterol level is observed[7].

In cats with triaditis, abdominal ultrasound image depends on the organ affected by the disease:

- pancreatitis – in the case of an acute inflammation, the pancreas is enlarged and its parenchyma is hypoechogenic, as opposed to the surrounding adipose tissue, which is hyperechogenic. When it comes to a chronic pancreatitis, the shape of the organ may be normal or irregular; sometimes widening of the pancreatic duct may be observed;
- cholangitis – thickening of the wall and widening of intra- and extrahepatic bile ducts, increased density of the bile in the gall bladder and thickening of the gall bladder wall are observed.
- inflammatory bowel disease – segmental or overall thickening of the entire intestinal or muscular layer, the effacement of the laminar intestinal structure and the enlargement of mesenteric lymph nodes are observed. It should be noted that the lack of ultrasound intestinal lesions does not exclude inflammatory bowel disease.

The results of clinical examination, laboratory blood tests, and ultrasound examination may significantly raise the suspicion of triaditis. Therefore, diagnosis should preferably be made on the basis of biopsy and either histopathological or cytological examination of individual organs. Nevertheless, it is not always an option.

Treatment

The management of a cat with triaditis should be based on the assessment of the severity of an individual organ disease[7]. The general rules of triaditis management are provided in Table 1.

In a clinical practice, it is often impossible to perform biopsy and histopathological examination of the pancreas, liver, and intestines at the same time. Therefore, the therapy opted for should be directed at the treatment of the organ which is most severely damaged. However, caution should be taken. Therapy should always be performed in such a manner not to deteriorate the condition of another organ of the triad. For example: if IBD is identified as an underlying cause of triaditis, intestinal symptoms are most severe, tests show neutrophilia, and cholangitis is suspected, then before administering glucocorticoids, one should start with antibiotic therapy since there may be an active bacterial bile duct infection. When it comes to cats struggling with acute vomiting, hypovolemia, or reduced pressure there is the need to administer fluid intravenously in order to hydrate the animal and balance electrolytes, as well as give it antiemetics to stop vomiting. On the other hand, if a clinical examination shows a strong pain of the abdominal cavity (acute pancreatitis), it is highly advised to administer analgesics and opioids are the drugs of choice. In cats with the loss of appetite, it is recommended to use appetite stimulators. If they are not effective, one should proceed to force feeding through a nasoesophageal or nasogastric tube.

Management of pancreatitis

The management of pancreatitis in cats is mainly based on symptomatic therapy and includes: fluid therapy, analgesics, antiemetics, and a proper dietary management.

Fluid therapy (acute vomiting and/or acute diarrhoea) is aimed at supplementing systemic fluids and maintaining a desired pancreatic microcirculation. It should be kept in mind that pancreatic ischaemia secondary to dehydration may cause necrotic pancreatitis.

In the case of vomiting, antiemetics are recommended (e.g.: maropitant, ondansetron). They prevent the loss of fluids and electrolytes thus eliminating hypovolaemia hypo- and hyponatraemia. In the case of unsuccessful maropitant therapy, it is recommended to opt for the combination of maropitant and ondansetron therapy.

In animals with abdominal pain, it is strongly advised to administer opioid analgesics (e.g. buprenorphine, fentanyl). It should be emphasized that in the case of pancreatitis, nonsteroidal anti-inflammatory drugs are contraindicated.

Dietary management with regard to feline pancreatitis includes highly digestible diet characterized by reduced fat content and aimed at animals with intestinal diseases or the so-called elimination diet based on low content of fat[11].

Antibiotic therapy should be started in cats with pancreatitis and leucocytosis.

In the case of an acute pancreatitis, it is not recommended to opt for glucocorticoid therapy. In some cats with chronic pancreatitis and excluded neutrophil hepatitis, remarkable effects are achieved thanks to prednisolone therapy. It is difficult to state whether it is associated with the limitation of pancreatitis or the successful therapy of existing IBD[13].

Tab.1. Treatment of pancreatitis, cholangiohepatitis and inflammatory bowel diseases in cats with triaditis

	Pancreatitis	Cholangiohepatitis	Inflammatory bowel disease (IBD)
Fluid therapy	crystalloids and colloids	crystalloids	In acute and severe cases
Antibiotics	in the case of a confirmed bacterial infection: neutrophilia, suspicion of bacterial translocation Enrofloxacin at 5 mg/kg b.w./24 h, SC, PO	in the case of neutrophilic cholangitis, bacterial translocation Enrofloxacin at 5 mg/kg b.w./24 h, SC Amoxicillin with clavulanic acid at 12.5 mg/kg b.w BID, SC, PO	In the case of neutrophilic inflammation
Antiemetic drugs	Maropitant at 1 mg/kg b.w., SC, SID, Ondansetron at 0.5-1.0 mg/kg b.w. PO, SID	Maropitant at 1 mg/kg b.w. SC, SID Ondansetron at 0.5-1.0 mg/kg b.w. PO, SID	Maropitant at 1 mg/kg b.w.., SC, SID Ondansetron at 0.5-1.0 mg/kg b.w. PO, SID
Immunosuppressive therapy	in the case of chronic pancreatitis: prednisolone at 1-2 mg/kg b.w. PO, SID	In the case of lymphocytic cholangitis Prednisolone at 1-2 mg/kg b.w. PO, SID	prednisolone at 1-2 mg/kg b.w. PO, SID or BID Chlorambucil (in severe IBD) 2 mg/cat 2-3 times a week
Vitamins	Cobalamin at 250 µg/cat S.C. SID	Vitamin K (in the case of coagulation problems) at 0.5-1.5 mg/kg b.w. SC, BID 3 doses of cobalamin at 250 µg/cat S.C., SID	Cobalamin at 250 µg/cat S.C. SID for 6 weeks
Nutraceuticals	Rarely	SAMe at 2 mg/kg b.w. PO BID UDCA at 10-15 mg/kg b.w. PO, SID	Prebiotics

*based on 9, 10, 11, 13

Therapy of cholangiohepatitis

The therapy of cholangiohepatitis in cats is mainly based on antibiotic therapy. An antibiotic should be chosen basing on the microbiological examination and antibiotic susceptibility tests of the samples collected by fine-needle biopsy of the liver and/or gallbladder. When biopsy is not feasible, wide spectrum antibiotics, effective against Gram positive, Gram negative, aerobic, and anaerobic bacteria, should be administered. They should be given for 4-6 weeks. The aforementioned therapy may be complemented with antioxidants such as S-adenosyl methionine (SAMe), silybin, and vitamin E. In the case of cholestasis, ursodeoxycholic acid (UCDA) should be administered.

The treatment of cats with lymphocytic hepatitis is based on immunosuppressive therapy with prednisolone. It should be continued for 4-6 weeks. If the outcome of the treatment is satisfying, the dosage of prednisolone should be gradually reduced to the lowest effective dosage. Chlorambucil may be taken into account in the case of poor effects of prednisolone therapy[13].

Inflammatory bowel disease

The therapy of inflammatory bowel disease in cats is the combination of a correct dietary management and antibiotic and/or immunosuppressive treatment. One has to remember that IBD therapy depends on the type of inflammatory infiltrate (lymphoplasmacytic, eosinophilic, neutrophilic, and granulomatous) and disease severity. Proper dietary management is usually sufficient in the case of mild inflammatory bowel disease and it includes a hydrolysed protein diet or elimination diet based on one type of protein[12].

In cats with a moderate or advanced form of the disease, apart from the recommended dietary management, antibiotics (usually metronidazole or tylosin) and/or glucocorticoids (usually prednisolone) are given. If they prove ineffective, than feline IBD may be treated with chlorambucil, azathioprine, or cyclosporine.

In the case of vitamin B12 deficiency, it should preferably be supplemented via parenteral route.

To sum up, it should be emphasized that forecasts for a cat with diagnosed triaditis may vary. They depend on many factors such as: the exacerbation of clinical symptoms, degree of organ damage, and response of the animal to the applied treatment.

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Product description in Vet Pharmacy

Idiopathic chylothorax in cats – diagnostics and management

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Abstract: Idiopathic chylothorax is a rather rare disease that cats suffer from. No breed, gender, or age predispositions were found. It is quite often required to perform extensive diagnostics (cytology, imaging examination – X-ray, USG, CT with contrast) in order to identify primary causes of lymph accumulation in the pleural cavities. In many cases however, the determination of the cause is not possible and the only form of therapy is surgical intervention, which allows to eliminate symptoms and considerably improve the quality of life of the patient. A balanced pharmacotherapy and proper dietary management are important elements of therapy.

Key word: idiopathic chylothorax, cat

Introduction

Idiopathic chylothorax in cats is a disease that is associated with lymph accumulation in the pleural cavities without any identifiable cause. Lymph is defined as a bodily fluid which transports proteins, fat, and lymphocytes. In physiological conditions, it circulates in the lymphatic system and detoxifies both tissues and organs. Said process is supported by lymph nodes draining lymph from individual segments of the body, lymphatic vessels, and the thoracic duct. Chylothorax develops when the thoracic duct, which normally drains lymph from the caudal part of the body (as well as from the left part of the head, neck and thoracic legs) becomes ruptured, which in turn leads to lymph accumulation between the parietal pleura (lining thorax from the inside) and the visceral pleura. Physiologically, lymph from the thoracic duct drains into the left brachiocephalic vein at the thoracic inlet. As a result, each pathology occluding the aforementioned physiological route of lymph transportation increases lymphatic pressure and leakage of lymph from thoracic vessels.

Aetiology

Chylothorax may be caused by:

- tumours[2]
- trauma[3,4]
- congenital pathologies of thoracic duct[5]
- blastomycosis[6]
- tumours in the cranial mediastinum[6]
- cardiac diseases[7,8]: right-sided heart failure caused by constrictive pericarditis, heart base tumours e.g. Fallot tetralogy, tricuspid valve dysplasia,
- dirofilariosis[9,10]
- lung lobe torsion[11]
- cranial vein thrombosis[7]

All the remaining cases with unidentified causes are classified as the idiopathic chylothorax of unknown aetiology.

Diagnostics

Clinical symptoms which are reported by pet owners include dyspnoea, coughing, weakness, apathy, loss of appetite, and secondary reduction of body weight. During a clinical examination of the patient with severe hydrothorax, one may observe increased respiratory rate (up to 60/min), muffled breath sounds, as well as horizontal reduction upon thoracic percussion[12]. Blood tests and urinalysis remain within normal range limit[12] in the said scenario.

After the confirmation of the presence of fluid in tFAST and in diagnostic and therapeutic thoracentesis, it is recommended to perform radiography of the thorax in minimum 3 projections. Fluid, which is often accumulated in the pulmonary cavities, causes advanced oedema which may cover the majority of pulmonary surface and significantly hinder their assessment upon imaging-based examination. In the case of the presence of fluid, radiography does not allow to draw any conclusion. It should be also remembered that the compressed lungs cannot be evaluated during a computed tomography. In order to exclude the cardiovascular component of hydrothorax, it is also vital to perform echocardiography.

Fluid collected by thoracocentesis should be subjected to cytopathological and microbiological

Tab. 1. Diagnostic guidelines for the interpretation of examinations of fluid from bodily cavities

Fluid	Macroscopically	Total protein (g/dL)	Nucleated cells (x 103/ uL)	Cytology	Comment
Lymph – initial stage	Milky and cloudy chylomicrons are on the surface	> 3.5	> 10	Usually small, well-differentiated lymphocytes – precipitates of chylomicrons	TRIG > 100 mg/dL and the concentration is significantly higher than in the serum/plasma
Lymph –chronic stage	Milky and cloudy	> 3.5	> 10	Small lymphocytes and precipitates, more macrophages and neutrophils	TRIG > 100 mg/dL and the concentration is significantly higher than in the serum/plasma

examination. What is more, the composition of the fluid (triglycerides, total protein, albumins, specific gravity) should be identified as well. Normally, lymph shows a high concentration of triglycerides and cholesterol, high protein concentration, and white colour of supernatant. Detailed lymph biochemical parameters are provided in Table 1

If chemical tests of the fluid collected from bodily cavities are not feasible, then an indirect hint is provided by the lack of significant changes in the fluid after centrifuging it, which suggests that it is lymph. Obviously, there will be also a cellular sediment. Nevertheless, supernatant will remain opaque, white, and opalescent. The concentration of triglycerides in the fluid is higher than in blood serum ,whereas cholesterol concentration may be similar or lower in the serum.[7,12]

Cytopathological examination frequently shows the presence of lymphocytes, neutrophils, and reactive mesothelium or even erythrocytes[13].

In the case of long-term respiratory problems in feline patients, there is a risk of the development of post-inflammatory adhesions and fibrin conglomerates formation on the parietal pleura, which manifests itself with pain and the lack of procedure tolerance in the case of thoracocentesis without the administration of systemic and/or local analgesics. It is proposed to perform the procedure under a general anaesthesia, since advanced hydrothorax may have a negative impact on anaesthesia. Careful patient monitoring is required.

If focal lesions in the cranial mediastinum are suspected, it is advised to perform ultrasound--guided biopsy. Cytological test results vary depending on the medium and it may be a reactive sternal lymph node[12], lymphoma, or a lesion of other type

Management

The first and most essential step of the management and the complementation of diagnostics of chylothorax should be thoracocentesis. It should be performed slowly and only in the case of dyspnoea. A significant improvement of respiratory efficacy is observed even after the elimination of as little as 10 mL of fluid/kg b.w. in the feline patient. The fluid should be removed slowly in order to prevent a sudden decompression of the lungs – it may damage pulmonary alveoli. The excessive removal of the fluid may be also associated with dehydration, hypoproteinaemia, hyponatraemia, and hyperkalaemia, which obviously are all associated with a high risk of rhythm disturbance[14].

Pharmacotherapy

Pharmacotherapy and symptomatic therapy of idiopathic chylothorax includes low-fat diet[12], thoracocentesis, as well as the limitation of physical exertion.[15] Besides, it is recommended to introduce rutosid[12]. In patients which are not surgically treated, the mortality rate may reach even 80%. In the quoted study, only one cat was given steroids orally.

Rutoside (rutin) is a chemical compound extracted from plants. It is available as a nutraceutical in shops and over the counter in pharmacies, for example - in the form of Rutinoscorbin. Organoleptic properties of the product make it adequate for feline patients, which tolerate its flavour and smell very well. It is sometimes used in human medicine during the treatment of oedema after the removal of the auxiliary lymph node. In lower doses, it is a commonly known to decrease the severity of mild infections of upper respiratory tract, as the product in question may "enhance immunity". A precise mode of its operation remains unknown. Nevertheless, it is suspected that rutin reduces the permeability of vessels, stimulates proteolysis, eliminates protein-based substances from tissues, as well as supports lymph phagocytosis by tissue macrophages.[16] According to the literature of the subject, it may be successfully used at 250 mg per os every 8 hours. Afterwards, the dosage should be gradually reduced to 500 mg every 24 h.[17,18] Venoruton Forte 500 mg is available on the Polish market and the content of an active substance is incomparably higher to the one in Rutinoscorbin.

If there is no clinical improvement of idiopathic chylothorax after a pharmacological therapy within 5-10 days, a surgical intervention remains the therapy of choice. The ligation of the thoracic duct allows to eliminate hydrothorax in about 50% of cases.[26] Long-term chylothorax may lead to the emaciation of the body and the development of fibrosing pleuritis.[27]

Surgical treatment is based on the possibility of eliminating the underlying cause, whereas in idiopathic cases, it is still possible to try to ligate the thoracic duct and to apply an active or passive drainage in the form of pleuroperitoneal shunt.[7] Spontaneous remission for unknown reasons is sometimes observed.[12]

Surgical treatment

The first reports on the possibility of surgically treatment of chylothorax in small animals were published in 1958[4]. As of currently, said method is applied in the majority of cases (93%; 68/73)[1]. However, (at least in cats) pharmacotherapy is still applied. Among the available methods, thoracic duct ligation (TDL) is performed with or without pericardiectomy (subtotal pericardiectomy, SP), and optionally cisterna chyli ablation, (CCA), or pleurodesis[19].

The efficacy of the ligation of the thoracic duct combined with pericardiectomy is 77% (6 months), 73% (12 months), and 57% (24 months)20. According to recent peer-reviewed publications, about 7% of the cats undergoing a surgical treatment of chylothorax require yet another surgery and the most effective method (the least frequently associated with the need to repeat the procedure) is TDL. Unfortunately, according to data based on the publications from the period of 1964-2018, the mortality rate associated with the procedure was nearly 57%(!) and was comparable, regardless of the method opted for1. Studies from 2018 (Stockdale et al.) shown that cisterna chyli ablation performed to complement the ligation of the thoracic duct and transdiaphragmatic pericardiectomy was dangerously prolonging the duration of the surgery without any improvement of the surgical efficacy[21]. At present, experienced operators perform said procedures thoracoscopically, which is associated with reduced pain after the procedure, the increase of the procedure safety, as well as the limitation of the consequences of significantly more extensive thoracic surgeries.[22]

In advanced severe cases of a complicated constrictive pericarditis, the treatment opted for may be successful with more complex surgical methods, such as the translocation of the omentum into the thoracic cavity in order to reduce chylothorax after the unsuccessful ligation of the thoracic duct[23]. Additionally, in the case of the existence of severe adhesions in the pulmonary cavity, the mechanical detachment of post-inflammatory tissue adhesions may be required.[24]

Yet another complication of a chronic chylothorax requiring surgical intervention may be a pulmonary lobe torsion. Clinical symptoms usually include dyspnoea or increased respiratory rate and the only successful treatment is surgical excision of the rotated lung lobe. A multicentre retrospective study[25] showed that lobectomy may be associated with a relatively high risk of death in a short period of time after the procedure completion (4/10 operated cats). Nevertheless, six cats that survived the first week after the surgery had a very good quality of life and were free of any symptoms of the disease.

Case study

A patient with a history of persistent dyspnoea and coughing lasting for 4-5 months was brought to the veterinary clinic. Initially, general practitioners used antibiotics and anti-inflammatory drugs due to the suspicion of a respiratory infection. After a short temporary improvement, the patient was brought for consultation with a recurrent problem. During the last visit, free fluid in the pleural cavity was found. Moreover, before said consultation the patient lost appetite and was hiding. Furosemide at 1 mg/kg IV was administered and the patient was referred to a specialist in veterinary cardiology. Due to the respiratory distress which was exacerbated by stress associated with veterinary consultations, a shortened echocardiography was performed and a cardiogenic cause was initially excluded. Thoracocentesis was immediately performed. It allowed to remove 200 mL of milky pink odourless fluid. Respiratory function was stabilized but due to the lack of the possibility of evacuating the fluid from the left pulmonary cavity. Oxygen therapy was started. Blood test results provided by the owner showed an increase of RBC, HCT, and albumin concentration in blood serum only. The examination was complemented in the clinic

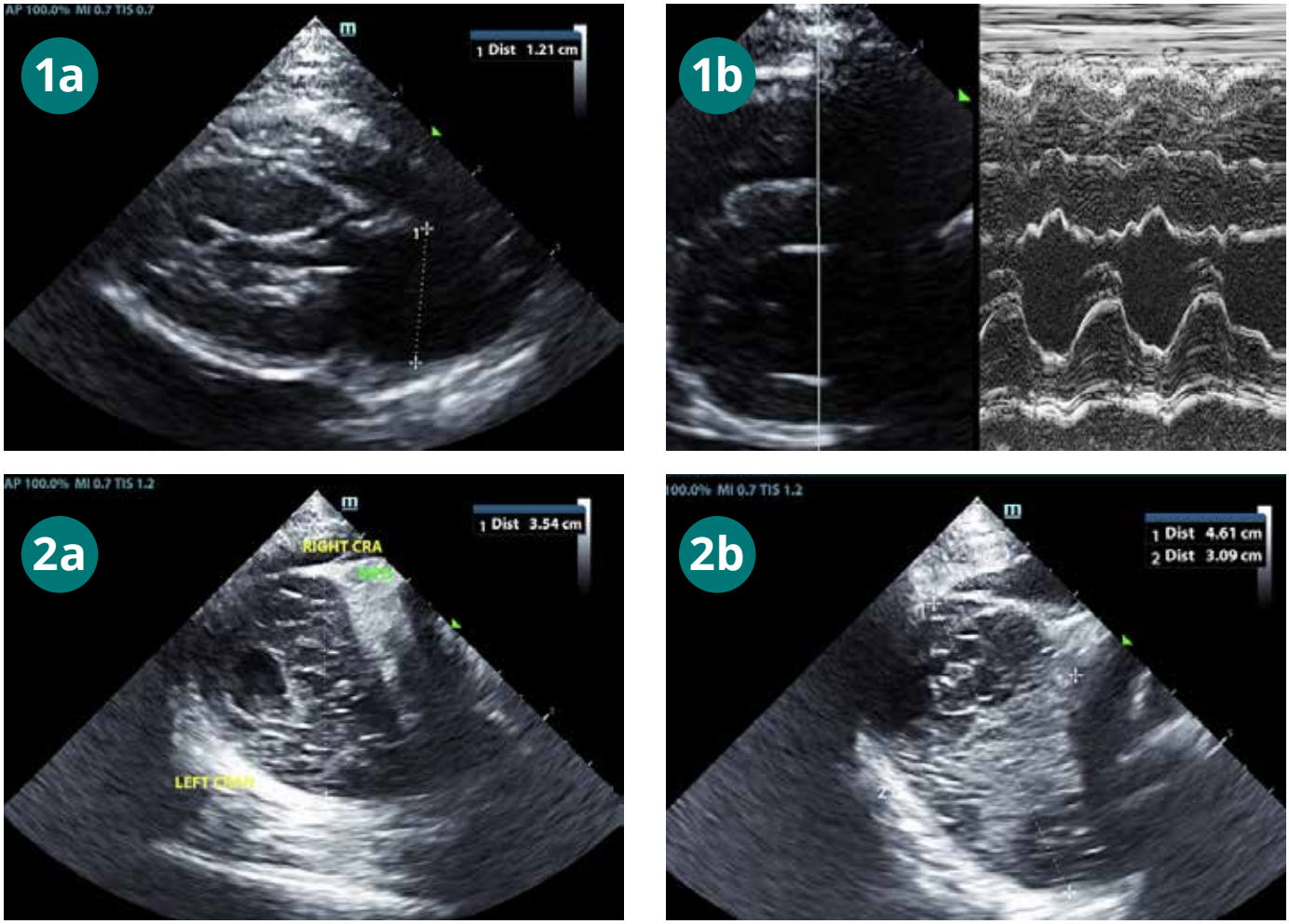
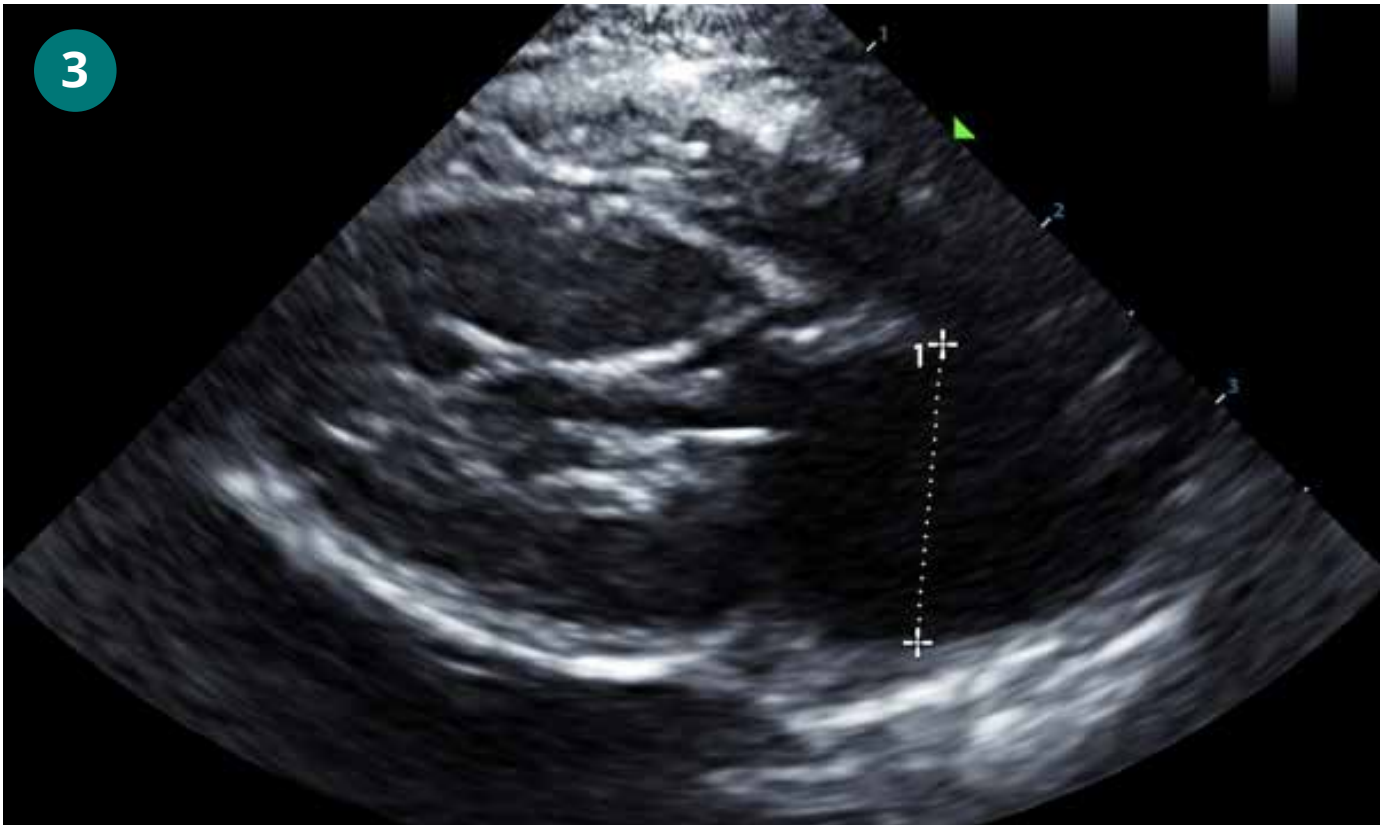


Fig. 1a. A complete echocardiographic examination was possible in the patient after thoracocentesis and the evacuation of the majority of accumulated lymph. The examination enabled to rule a cardiogenic background out. The laboratory analysis of the fluid plays a very important role in the differentiation of the causes of fluid accumulation. In the majority of cases of chylothorax secondary to heart failure, a modified transudate becomes accumulated and it is very rarely lymph, although it cannot be not excluded. A normal size of the left atrium was visualised in echogram. A normal LAD in cats is 16 mm. One has to pay attention that chylothorax secondary to right-sided heart failure is most commonly associated with widening jugular veins, which was not noticed in the patient.
Fig. 1b. The right-sided projection in a short axis, M-mode. The dimensions of the right and left ventricle, thickness of intervertebral septum, and the free wall of the left ventricle remained within the normal range. The systolic function was preserved.
Fig. 2a. Thorax ultrasound examination. After thoracocentesis and fluid evacuation, it showed a big, heteroechogenic lesion in the pre-cardial area, on the left side. Biopsy of the lesion did not show any atypical cells (MED – mediastinum).
Fig 2b. It is vital to apply an adequate projection aimed at specific changes to make it possible to make (an estimated) measurement in the widest area available.

with FIV/FeLV tests with a negative result. The analysis of the thoracic fluid showed protein (51 g/L), cholesterol (2,38 mmol/L), triglycerides (> 4.24 mmol/L) and the analysis performed with ProCyte IDEXX revealed leukocytes 20 tys/uL, severe neutrophilia, mono- and lymphocytosis, as well as basophilia (4,31 µ./uL) – Fig 4. The analysis of the fluid sediment showed the dominating population of toxic neutrophiles, numerous valid lymphocytes, and individual mesothelium cells. Besides, bacteria were found, so the sample was sent for microbiological tests. After incubation in growth medium, Staphylococcus epidermidis was cultured under anaerobic conditions and the bacteria was resistant to sulfadiazine/sulfamethoxazole with trimethoprim. Before the culture result was obtained, doxycycline at 6 mg/kg b.w. hours was given orally every 12 hours and dexamethasone in the form of sodium phosphate and phenylopropionate (Dexafort) at the total dose of 0.23 mg/kg b.w. were given intramuscularly. Probiotic was introduced and torasemide at 0.2 mg/kg b.w. was given every 24 hours orally. After a few days, during a follow-up visit, the owner noticed a significant improvement of the respiratory rate, appetite was recovered, and the cat ceased to hide. Abdominal ultrasound showed an image of the gastrointestinal tract and the pancreas that was suggestive of a chronic inflammation or a condition after the inflammation of an unknown aetiology e.g. contagious, dietary, drug-induced or mixed. In the case of the gastrointestinal tract-oriented examination, hyperaemia, the accumulation of lymph or other, mild enteropathy were also considered: the increased echogenicity of renal cortex and higher urinary density may result from lipidosis and lipiduria, which normally occur after castration. However, it is still possible that there is another cause. Kidney dysfunction may be associated with degeneration, pharmacotherapy, inflammation, or intoxication in the past. A follow-up ultrasound examination of the thorax revealed that the amount of the fluid was significantly reduced. Therefore, therapy with prednisolone at 1.3 mg/kg every 24 hours per os was continued. After 14 days, yet another thoracocentesis was performed and 250 mL of fluid was removed. A follow-up analysis showed mainly a significant reduction of white cells (neutrophils, eosinophils, basophils, lymphocytes, and monocytes) and a mild reduction of red cell count, whereas the biochemical composition remained nearly the same, apart from almost a twofold increase of cholesterol level as compared to the previous study (Fig. 5). Macroscopically, the colour changed from light pink to white (Fig. 6). Rutosid at 12.5 mg/cat every 24 hours was introduced, the dose of prednisolone was reduced by 50%, and torasemide was recommended only in the case of severe dyspnoea as the first line treatment before visiting the a veterinary clinic. Due to the lack of response to pharmacotherapy, the patient was referred to CT and for a surgical consultation. A complete echocardiographic examination was performed and the lack of a respective pathology was confirmed. No contraindications for general anaesthesia were found either. At present, the patient is awaiting another CT with contrast and a surgery.



RBC	0.09	6.54 - 12.20 x10^12/L	L
Haematocrit	0.005	0.303 - 0.523 L/L	L
Haemoglobin	22	98 - 162 g/L	L
MCV	55.6	35.9 - 53.1 fL	H
MCH	244.4	11.8 - 17.3 pg	H
MCHC	4,400	281 - 358 g/L	H
RDW	- --,--	15.0 - 27.0 %	
% Reticulocyte	- --,--	%	
Reticulocytes	* 13.3	3.0 - 50.0 K/µL	
Reticulocyte Haemoglobin	* 18.1	13.2 - 20.8 pg	
WBC	* 20.53	2.87 - 17.02 x10^9/L	H
% Neutrophils	* 46.1	%	
% Lymphocytes	* 25.4	%	
% Monocytes	* 1.8	%	
% Eosinophils	* 5.7	%	
% Basophils	* 21.0	%	
Neutrophils	* 9.46	2.30 - 10.29 x10^9/L	
Lymphocytes	* 5.21	0.92 - 6.88 x10^9/L	
Monocytes	* 0.37	0.05 - 0.67 x10^9/L	
Eosinophils	* 1.18	0.17 - 1.57 x10^9/L	
Basophils	* 4.31	0.01 - 0.26 x10^9/L	H
Platelets	0	151 - 600 x10^9/L	L
MPV	9.3	11.4 - 21.6 fL	L
Plateletcrit	0.00	0.17 - 0.86 %	L
Total Protein	51	57 - 89 g/L	L
Albumin	22	22 - 40 g/L	
Globulin	29	28 - 51 g/L	
Albumin: Globulin Ratio	0.8		
Cholesterol	2.38	1.68 - 5.81 mmol/L	
Triglyceride	> 4.24	0.11 - 1.13 mmol/L	H

Serology

30/3/2023	8:25 PM
TEST	RESULT
FeLV Antigen (ELISA)	Negative
FIV Antibody (ELISA)	Negative

Fig 4. Results of pleural cavity fluid and tests for contagious diseases (feline leukemia and immunodeficiency virus).

Fig 3. Lung USG, caudal thoracic region, before thoracocentesis on the left side. Advanced chylothorax with organising conglomerates of fibres visible in the form of hyperechogenic bands with hypoechogenic fluid in the background was visualised. One has to keep in mind individual differences in connection between the left and right pleural cavity. They remained separated, which confirms that there had been the inability to remove the whole accumulated fluid from one side of the thorax.

RBC	0.01	6.54 - 12.20 x10^12/L	L	0.09
Haematocrit	0	0.303 - 0.523 L/L	L	0.005
Haemoglobin	27	98 - 162 g/L	L	22
MCV	0.0	35.9 - 53.1 fL	L	55.6
MCH	- --,--	11.8 - 17.3 pg		244.4
MCHC	- --,--	28.1 - 35.8 g/dL		4,400
RDW	- --,--	15.0 - 27.0 %		- --,--
% Reticulocyte	- --,--	%		- --,--
Reticulocytes	* 2.9	3.0 - 50.0 K/µL	L	* 13.3
Reticulocyte Haemoglobin	* 14.6	13.2 - 20.8 pg		* 18.1
WBC	2.10	2.87 - 17.02 x10^9/L	L	* 20.53
% Neutrophils	52.8	%		* 46.1
% Lymphocytes	30.0	%		* 25.4
% Monocytes	2.4	%		* 1.8
% Eosinophils	6.2	%		* 5.7
% Basophils	8.6	%		* 21.0
Neutrophils	1.11	2.30 - 10.29 x10^9/L	L	* 9.46
Lymphocytes	0.63	0.92 - 6.88 x10^9/L	L	* 5.21
Monocytes	0.05	0.05 - 0.67 x10^9/L		* 0.37
Eosinophils	0.13	0.17 - 1.57 x10^9/L	L	* 1.18
Basophils	0.18	0.01 - 0.26 x10^9/L		* 4.31
Platelets	0	151 - 600 x10^9/L	L	0
Total Protein	47	57 - 89 g/L	L	51
Albumin	20	22 - 40 g/L	L	22
Globulin	26	28 - 51 g/L	L	29
Albumin: Globulin Ratio	0.8			0.8
Cholesterol	4.02	1.68 - 5.81 mmol/L		2.38
Triglyceride	> 4.24	0.11 - 1.13 mmol/L	H	> 4.24

Fig 5. Results of a follow-up analysis of the fluid collected from thorax after 14 days. In a control analysis, a significant decrease of white cells (neutrophils, eosinophils, lymphocytes, and monocytes), as well as a mild reduction of red blood cells were identified. Blood chemistry results remained normal, apart from almost twofold increase of cholesterol as compared to the previous test (test results on the left side for comparison).

Summary

Even though chylothorax is infrequently found, idiopathic chylothorax in cats may be a challenge in a daily veterinary practice and may require the application of advanced diagnostic methods, as well as a careful management of a feline patient. Respiratory symptoms are often neglected and there is the need to remember that a patient with the increased respiratory rate or - what is even more alarming - breathing with open mouth has already used its functional reserved and requires immediate help. Thoracocentesis is an essential skill in veterinary practice and no practitioner should be afraid to perform it. Besides, one always has to (!) remember to perform cytological, microbiological examination, and the biochemical analysis of body fluid – the results obtained may be quite often a surprise for a veterinarian.

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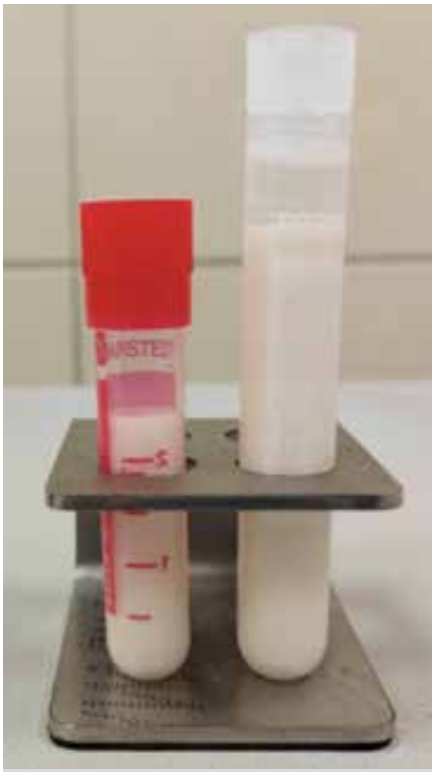

Fig. 6 Lymph collected from the pleural cavity is macroscopically similar to milk.

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A slimming diet for cats – specificity, calorie intake, and feeding amount

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Abstact: Slimming is a controlled introduction of a particular cat into a negative energy balance with the support of an appropriate reduction diet. Its advantages are low calorific value and moderately high protein content. Supporting the slimming process is possible thanks to the introduction of additional nutrients, including: L-carnitine, PUFA, choline and a set of antioxidants. The slimming process does not end with achieving the desired weight of a particular feline. It has to be mentioned that only those animal keepers who manage to change eating habits of their animals for a long period of time and maintain their body weight initially obtained in the course of the weight loss-oriented process can be considered successful.

Key words: cat, slimming, diet

Introduction

Cats are becoming increasingly popular as pets. What is more, the vast majority of them are sterilised. Unfortunately, castration, the limitation of physical activity, as well as the constant availability of high-calorie feed contribute to the development of excess body weight and obesity[6]. As of currently, it is estimated that about 35-50% of cats suffer from being either overweight or obese[2]. Due to the fact that the issue of excessive body weight is well known in humans, the owners of overweight cats are frequently fully aware of the risks related to such a state of affairs, such as diabetes mellitus, lower urinary tract diseases, cancer, cardiologic problems, as well as the increase of health risks in the case of many medical procedures, e.g. dental treatment. Therefore, currently, it is much easier to discuss the matter of animal obesity in a veterinary clinic than it was just a few years ago.

The reduction of excess body weight is based on the limitation of calorie intake and the increase of energy used during various kinds of physical activity. Unfortunately, both goals are rather difficult to implement in the case of cats, mainly due to their specific food-related preferences (common neophobia) and a limited physical activity caused by age. Nevertheless, it is also highly recommended to involve a particular cat owner in finding the most optimal physical activity for his or her pet (playing with a ball, usage of certain interactive tools, walks etc.) since he or she knows his or her pet best. In the case of diet, one should select and suggest a few products that are known for their efficiency while utilized as a part of a reduction diet and may be included in the slimming cycle of a cat. The so-called transient period has to be taken into account, during which the usual feed should be mixed with the elements of a new diet. A period of switching a given cat to new feed should last from 10 to 30 days.

A weight-loss diet – a controllable energy deficit with a balanced protein content

A weight-loss diet allowing to reduce excessive body weight in compliance with EU regulations must be a low-calorie one. The content of metabolic energy must be lower than 3190 kcal/kg of a complete feed with 12% moisture, which remains in line with the FEDIAF formula specifying that 1000 g of dry matter have 4000 kcal. When compared to a wet diet, the amount of calories must be lower than 580 kcal/kg of a complete feed with 85% moisture in the case of calculating energy in the same way, namely - basing on the formula recommended by the FEDIAF.

Energy deficit combined with the increased share of protein in diet allows for progressively burning fatty tissue and maintaining muscle mass. Thus, it is recommended to start a reduction diet containing from 10 to 18 g of protein per 100 kcal (40-60% of dry matter). The majority of weight loss-oriented diets are based on a poultry-based protein, which is characterized by the most optimal (after egg protein) balance of amino acids. Nevertheless, there are no contraindications to include other sources of protein (monoprotein diets for obese pets with allergies) as well or to opt for their combination (lean fish, lean beef, pork, guinea hen etc.). Many years have been devoted to searching for an ideal diet which would lead to optimum body weight reduction and ensuring a proper satiety. It seems that remarkably satisfying results have been obtained with a low calorie diet containing a moderately high amount of protein (about 35% of total calories), low amount of carbohydrates, and moderate amount of fibre[1,11].

Fat and other nutrients in a weight-loss diet

The main source of energy is fat, which - during the burning process - leads to obtaining at least twice as much energy than in the case of burning of proteins and carbohydrates. The recommended amount of fat when it comes to a weight-loss diets is between 2.5 to 5 g per 100 kcal (i.e. 6-20% of dry matter) of diet. Fat is also considered to be the source of essential fatty acids (mainly arachidonic acid) and fat-soluble vitamins. Arachidonic acid is essential for felines, but the endogenic synthesis of said acid is not sufficient although still feasible, which was proved by the study conducted by Sinclair et al. They proved that in the case of availability of γ- linolenic acid, cats may synthetize endogenic arachidonic acid from γ-linolenic acid and that it is catalysed by Δ5-desaturase enzyme[16]. On the other hand, the experiment carried out by Trevizan et al. showed the possibility of producing arachidonic acid from γ-linolenic acid while at the same time excluding the involvement of Δ6-desaturase[17]. It was also suggested that said enzyme is not induced at the higher amount of linoleic acid in diet[17]. Even though a detectable amount of Δ6 and Δ5 desaturase products was shown in the cat liver, their activity is too low to maintain a stable synthesis of long-chain polyunsaturated fatty acids at a high level (PUFA)[15]. Nevertheless, the aforementioned acids, play an important role in the body thanks to the production of specific eicosanoids. Their involvement in weight-loss diet protocols is based on the inhibition of pro-inflammatory mediator synthesis and the promotion of anti-inflammatory mediators. It was confirmed that in the case of obese cats, receiving PUFA in the amount of 1.01% ALA, 3.91% EPA, and 4.72% DHA caused their insulin sensitivity improvement[19].

Mazaki-Tovi et al. showed that EPA blood levels in obese cats are positively correlated with the concentration of adiponectin and are proportionally inverse to the concentration of insulin and triglycerides[12, 13]. The aforementioned studies suggest the possibility of opting for PUFA to support the therapy, as well as to prevent disorders that are strictly associated with obesity in cats[12, 13]. When discussing fatty acids, there is also the need to mention a substance which facilitates their entrance into mitochondria, namely -L-carnitine, which is a quaternary amin synthetized in the body de novo in the liver and kidneys from lysin and methionine in the presence of ascorbates. The inclusion of L-carnitine into a weight-loss diet improves the retention of nitrogen and the maintenance of lean mass. The probable mechanism of this reaction is predominantly based on the enhancement of fatty acid oxidation and the availability of energy for the process of protein synthesis[8]. In one of the studies on obese cats, a 20% reduction of baseline body weight was achieved within 18 weeks when a weight-loss diet was initiated and a water-based solution of L-carnitine at the dose of 250 mg/kg was given twice a day[4]. Furthermore, the addition of choline plays an important role in the diet of obese cats since it facilitates the transportation of lipids out of the liver. Therefore, choline may contribute to the reduction of the risk of fatty liver syndrome occurring[18]. Choline is a vitamin-like substance which leads to the increase of serum CHOL, TH, lipoprotein, and methionine concentrations. At the same time, it reduces urea nitrogen level and alkaline phosphatase activity, as well as decreases the acylcarnitine-to-free-carnitine ratio. The minimal recommended dose of choline for a cat is 50 mg/kg (b.w.)0,67 and the optimum recommended dose is 63 mg/kg (b.w.)0,67[14]. The formula of a weight-loss diet may also incorporate other substances supporting weight loss thanks to controlling the amount of free oxygen radicals. Anti-inflammatory and anti-oxidative active substances from, among others, herbal extracts support endogenic mechanisms. One of the most commonly provided examples is quercetin which was administered at the dose of 2.5-3 mg/kg b.w./day for 4 weeks in an study conducted in healthy obese cats. The study indicated the reduction of inflammations confirmed by a notably lower concentration of SAA and the decrease of total cholesterol level, AST, and ALT activity[9].

Recommendation to use a moderate amount of fibre and its impact on the microbiota

There is also the need to remember about fibre since its high amount in slimming diet is currently not recommended, especially in the case of coexisting diabetes[10]. Bennet et al. compared the efficacy of low carb–low fibre diet (where the amount of carbohydrates was 3.5 kg/100 kcal and of fibre - 0.1 g/100kcal) with a moderate carb–high fibre diet (where the amount of carbohydrates was 7.5 g/100 kcal and of fibre - 11.5 g/100kcal) in obese diabetic cats. The study showed the higher effectiveness of a low carb-low fibre diet with regard to the management of the disease[3]. As of currently, the majority of scientists seem to prefer a moderate amount of fibre in a weight-loss diet for cats that need to become slimmer and for felines with diabetes (5-15% of dry matter)[6,13]. It should be remembered that the addition of prebiotic fibre allows for the regulation of microbiota, which is often disrupted in overweight animals.

Selection of the diet and calorie-counting

The selection of a weight-loss diet and its acceptance by a given cat are the initial steps in slimming process. A very important aspect is the adequate estimation of daily energy requirement (DER) for a cat that has to lose weight to achieve a progressive weight reduction. Adequate formulas for calculations are provided in Table 1. It is vital to obtain factual information from the cat owner pertaining to the current number of calories consumed. Therefore, it is recommended to determine how many grams of the specific feed of particular specificity are consumed daily by a cat. Afterwards, said value should be compared to the calculated value of DER. It will make it possible to eliminate the error of calculating more energy than the cat currently takes. Yet another step is the monthly modification of the ration based on the progress of weight-loss while assuming 0.5% body weight loss within a week[51].

Tab.1. Suggested DER (Daily Energy Requirement) formulas in the slimming process.

No.	Suggested formula
1	DER = RER* x 1 where RER is calculated basing on (actual cat body weight in kg)^{0,40}
2	DER = RER* x 0,8 where RER is calculated basing on (optimum cat body weight in kg)^{0,67}
3	DER = (30 x optimum cat body weight in kg + 70) x 0.8

RER – Resting Energy Requirement

The principle of the so-called slimming philosophy should also be applied. It states that if body weight loss by about 5-6% results in visible clinical effects and improves the comfort of the cat, it may be sufficient and the ideal body weight should not be pursued[7].

Summary

At the end, it has to be emphasized that reaching the target body weight is not the end of a slimming process. Once the desired body weight has been achieved, it also needs to be maintained. Unfortunately, the return to the previous manner of feeding usually nullifies the efficiency of the entire endeavour and leads to the so-called "yo-yo" effect. Therefore, after the completion of the weight-loss period, food and daily ration should be chosen in such a way to maintain the optimum body weight of the cat.

References available at the editorial office

Product description in Vet Pharmacy

Supplements for cats in a convenient twist-off capsule and in the form of a paste

Hepatiale Forte

The preparation made for dogs and cats, aiming at the proper functioning of the liver. A combined preparation containing, among others: lecithin, glutamine, and arginine. Phosphatidylcholine improves the pace of the fat metabolizing, has a protective effect on hepatocytes, supports the regeneration and stabilization of hepatocyte cell membranes, as well as protects the liver against damages of various kinds. Arginine and glutamine are amino acids that are ornithine precursors in the urea cycle. They serve an important role when it comes to nitrogen metabolizing, as well as facilitate the removal of ammonia from the body.
Form: twist-off capsules.

KalmVet

The preparation made for dogs and cats, aiming at the alleviation of the symptoms of stress, anxiety, aggression and other behavioral problems. A combined preparation containing, among others: chamomile, tryptophan, and valerian. When administered in advance, it counteracts harmful symptoms of stress in a natural, gentle, long-term, and effective manner.
Form: twist-off capsules.

VetoSkin

The preparation made for dogs and cats, aiming at the support the proper functioning of the skin and improving the quality of the hair coat. A combined preparation containing, among others, Omega 6 and 3 acids, GLA acid and zinc, biotin and B vitamins.
Form: twist-off capsules.

VetoMune

The preparation made for dogs and cats, aiming at the support of the functioning of non-specific immunity mechanisms. A combined preparation containing, among others: beta-glucan isolated from yeast and β- hydroxy -β- calcium methylbutyrate (Ca-HMB). The preparation may be administered to older and adolescent animals, as well as the ones during reproduction and convalescence phase.
Form: twist-off capsules.

BioProtect

The preparation made for dogs and cats, aiming at the optimization of the proper functioning of the gastrointestinal microbiota. The product contains live bacteria cultures (Enterococcus faecium, Lactobacillus acidophilus), as well as mannanoligosaccharides and fructooligosaccharides. It is recommended as a method to support the microbiome during the process of the treatment of gastrointestinal diseases.
Form: capsules.

Diagnostics - Quantitative tests for the Vcheck V200 analyzer

Vcheck Feline NT-proBNP

The test ensures a precise quantitative measurement of the concentration of B-type natriuretic peptide produced in cardiac muscle cells. NT-proBNP is used to differentiate dyspnea of cardiac and respiratory origin. It facilitates the diagnosis and treatment monitoring of the most common heart disease in cats - hypertrophic cardiomyopathy (HCM). It is a parameter that is helpful in determining the forecast and the risk of death from cardiac causes in cats. NT-proBNP is also taken advantage of as a screening test in cat breeds predisposed to heart diseases. It is additionally recognized as an essential parameter when it comes to the creation of the so-called anesthetic profile.

Vcheck Feline TnI

Cardiac troponin I (TnI) is a sensitive and highly specific marker of cardiac injury in dogs. An increase in its concentration is observed when cardiomyocytes are damaged. The test is used while diagnosing heart diseases, especially when it comes to the differentiation between myocarditis and cancer. The level of troponin I correlates with the severity of damage, making it an extremely helpful parameter when it comes to making forecasts about the patient's condition.

Vcheck Feline SAA 3.0

Serum amyloid A is the main acute phase protein in cats. Its quantitative measurement allows for the real-time assessment of the patient's condition. The concentration of SAA increases dramatically within 24 hours from the moment of the occurrence of inflammation/tissue damage, but drops to the reference value within a week from the moment of the implementation of a proper treatment. SAA measurement is useful when it comes to monitoring the patient's condition after surgery and probable complications. It turns out to be useful with regard to the early diagnosis of inflammation and assessing its dynamics, as well as to controlling the effectiveness of treatment.

Vcheck fPL 2.0.

A specific feline pancreatic lipase is an extremely sensitive parameter correlated directly with the assessment of pancreatic inflammation in cats. Its quantitative measurement allows for a precise diagnosis and management of the effectiveness of treatment.

Diagnostics - Veterinarian glucometer

Vet Expert BG Vet Pro

Veterinarian glucometer allowing for the precise control of glycaemia in dogs and cats. It requires a small volume of blood to perform the measurement. The device is compatible with Vet Expert BG Vet Blood Glucose Test Strips and Vet Expert BG Vet Control Solution Kit.

New dietary feed for cats in new packaging variants: sachets

Hepatic

Complete dietary feed for adult cats aiming at supporting their liver functioning in the case of chronic liver failure. The product ensures moderate levels of high-quality protein and remarkable levels of essential fatty acids.

Composition: meat and its derivatives (46% chicken), rice (3%); yeast (1% brewer's yeast), minerals (1%), oils and fats (0.5% salmon oil, 0.5% linseed oil). Protein source: chicken. Carbohydrate source: rice.

Analytical constituents: crude protein: 8%; raw fat: 5.7%; raw ash: 2.6%; crude fiber: 0.4%; humidity: 79%; Ca: 0.3%; P: 0.26%; Na: 0.18%; Cu (total content): 2mg/kg; Omega-3 fatty acids: 0.5%; Omega-6 fatty acids: 0.8%; EM (kcal/100g): 95.97.

Packaging: 100 g sachet

Intestinal

Complete dietary feed for adult cats, recommended for compensation for maldigestion, reduction of intestinal absorptive disorders, and for cases of chronic pancreatic insufficiency. A highly digestible diet with increased levels of sodium and potassium.

Composition: meat and its derivatives (50% chicken, 18% beef), vegetables (2% potatoes), minerals (1%), sugars (0.1% MOS; 0.1% FOS), oils and fats (0.2 % salmon oil), yeast (0.1%). Sources of easily digestible ingredients: chicken, beef.

Analytical constituents: crude protein: 11.1%; raw fat: 4.9%; raw ash: 3%; crude fiber: 0.4%; humidity: 78%; Na: 0.22%; K: 0.24%; EM (kcal/100g): 96.4.

Packaging: 100g sachet

Sensitivity

Complete dietary feed for adult cats, designed to reduce intolerance to specific ingredients and nutrients. Selected and limited to one protein source – wild boar meat.

Composition: meat and its derivatives (70% wild boar), minerals (1%). Protein source: wild boar. Analytical constituents: crude protein: 10.70%; raw fat: 5.9%; crude ash: 2.8%, crude fiber: 0.3%, moisture: 77%; EM (kcal/100g): 105.6.

Packaging: 100g sachet

Obesity

Complete dietary feed intended for adult cats, designed to reduce excessive body weight and regulate glucose supply. Low levels of mono- and disaccharides.

Composition: meat and its derivatives (68% chicken), vegetables (3% potatoes), fiber (1%), minerals (1%). Carbohydrate source: potatoes.

Analytical constituents: crude protein: 11.6%, crude fat: 2.10%, crude ash: 2.70%, crude fiber: 1.30%, moisture: 80%, starch: 0.75%, total sugars: 0%, EM kcal/100g):74.

Packaging: 100g sachet

New dietary feed for cats in new packaging variants: sachets

Urinary

Complete dietary feed for adult cats, aiming at dissolving struvite stones and preventing their re-formation. Dietary feed with urine acidifying and struvite metastabilizing properties, promoting the formation of urine unsaturated with struvite.

Composition: meat and its derivatives (64% chicken), cereals (4% ground rice), fruits (2% cranberries); minerals (1%).

Analytical constituents: crude protein 10.60%; raw fat 6.10%; raw ash 2.10%; raw fiber 0.40%; humidity 77%; P 0.21%; Ca 0.14%; Na 0.10%; K 0.22%; Mg 0.04%; Cl 0.23%; S 0.21%; EM (kcal/100g): 108.4.

Packaging: 100g sachet.

NEW - OBESITY DIET

Obesity

Complete and balanced dietary feed intended for adult cats for reduce excessive body weight.

Compositon: dried poultry meat (32%), barley (20%), sweet potatoes (15.5%), potato protein, wheat bran, corn gluten, poultry fat, beet pulp, monocalcium phosphate, glucosamine (500 mg/kg), brewer's yeast, mannanoligosaccharides (MOS - 200 mg/kg), chondroitin sulfate (200 mg/kg), fructooligosaccharides (FOS - 200 mg/kg), taurine 2500 mg/kg.

Analytical constituents: crude protein 38%, crude fiber 12%, crude fat 9%, crude ash 8%, moisture 6%, calcium 1.1%, phosphorus 1%, potassium 0.6%, sodium 0.4%, magnesium 0.06%, Omega-3 fatty acids 0.41%, Omega-6 fatty acids 1.65%. EM: 304kcal/100g.

Packaging variants: 0.4 kg, 2 kg, 6 kg

Announcement for 2024

Recovery

Complete dietary feed for adult cats, which supports convalescence and allows for the return to normal nutritional restoration. The product is characterized by high caloric value and a remarkable content of nutrients that are vital for cats. It is highly digestible feed.

Composition: meat and animal products (68% chicken), grains (2% oatmeal), minerals (1%), oils and fats (0.2% salmon oil).

Analytical constituents: crude protein 10.8%, crude fat 6.3%, crude ash 2.7%, crude fiber 0.4%, moisture 77%. EM (kcal/100 g): 114.3.

Packaging: 100g sachets

Diabetic

Complete dietary feed for adult cats, aiming at the regulation of glucose supply (Diabetes mellitus). Low levels of mono- and disaccharides.

Composition: meat and animal products (68% chicken), minerals (1%).

Analytical constituents: crude protein 10.3 %, crude fat 5.2%, crude ash 2.5%, crude fiber 0.3%, moisture 80 %, starch 0.3%, total sugar 0%. EM (kcal/100g): 110.3.

Packaging: 100g sachets

Announcement for 2024

1 *Renal - dry dietetic feed formula*

Complete and balanced dietary feed for adult cats, the purpose of which is to support kidney function in the case of chronic kidney failure.

Composition: eggs (26%), yellow peas (26%), hydrolyzed salmon protein (10%), hydrolyzed chicken protein (8%), chicken fat (8%), buckwheat (7%), dried apple pulp (6%), salmon oil (2%), hydrolyzed chicken liver (2%), egg shells (source of calcium, 1.5%), brewer's yeast (0.8%), potassium citrate (0.8 %), pea flour, psyllium husks and seeds (0.6%), dried algae (0.4%, Ascophyllum nodosum), chitosan (0.08%), mannanoligosaccharides (0.025%), β-glucans (0.022%), fructooligosaccharides (0.02%), Mojave yucca (0.02%), dried sea buckthorn (0.015%), inactivated Lactobacillus helveticus HA – 122 (15x109 cells/kg).
Analytical constituents: crude protein 22%, crude fat 18%, crude ash 5.1%, crude fiber 2.3%, moisture 10%, calcium 0.8%, phosphorus 0.5%, sodium 0.3%, magnesium 0.09%, potassium 0.5%, Omega-3 fatty acids 0.8%, Omega-6 fatty acids 2.9%, EPA (20:5 n-3) 0.2%, DHA (22:6 n-3) 0.3%, LA (18:2 n-6) 2.0%, taurine: 0.22%, arginine: 0.63%
Packaging variants: 0.4kg, 2kg, 6kg

2 *Renal - wet dietetic feed formula*

Complete and balanced dietary feed for adult cats, the purpose of which is to support kidney function in the case of chronic kidney failure

Composition: meat and its derivatives (26% chicken, 23% beef), rice (6%); minerals (1%), oils and fats (0.5% salmon oil). Protein source: chicken, beef.
Analytical constituents: crude protein: 8%; crude fat: 7.5%; crude ash: 2%; crude fiber: 0.5%; humidity: 76%; Ca: 0.2%; P: 0.16%; Na: 0.16%; K: 0.29%; Omega-3 fatty acids: 0.2%; Omega-6 fatty acids: 0.8%; EM (kcal/100g): 112.75.
Packaging: 100 g sachet

3 *RenalVet - supplement*

Preparation for dogs and cats aiming at the reduction of phosphorus levels, serving as a support in the treatment of chronic renal failure. A combined preparation containing, among others: calcium carbonate, chitosan, and vitamin D. The product should be administered during a meal. It effectively reduces the absorption of phosphorus from the gastrointestinal tract and supplements potential vitamin D deficiencies.
Form: twist-off capsules.

ORAL HYGIENE SUPPORTED BY VET EXPERT SUPPLEMENTS AND COSMETICS

PlaqueOff ® - Reduces the accumulation of dental plaque

The patented formula of the preparation contains powdered algae - *Ascophyllum nodosum* - that are harvested in the area of the Atlantic Ocean. The preparation is intended for daily use. The product in question reduces the adhesion of plaque to the tooth surface, softens hard tartar deposits, helps reduce the amount of bacteria, and eliminates unpleasant oral cavity odor.

A notable improvement is noticeable after 3-8 weeks of regular use. The product is recommended for animals of all ages, especially for those with a high tendency for tartar accumulation. The product is also recommended after oral cavity regeneration treatments.

References

1. Gawor J., Jank M., Jodkowska K. Klim E. Svensson U.K.: Effects of Edible Treats Containing Ascophyllum nodosum on the Oral Health of Dogs: A Double-Blind, Randomized, Placebo- Controlled Single-Center Study. Front. Vet. Sci. 5:168.doi: 10.3389/fvets.2018.00168

Stomaferin Ultra - the synergy of two active substances

Stomaferin Ultra contains two active substances: chlorhexidine and lactoferrin. Chlorhexidine is a broad-spectrum antiseptic that is often used in dentistry. Its antibacterial and bactericidal effect is based on damaging the bacterial cell membrane, which leads to cell death. Due to the fact that its molecule is negatively charged, it binds to the surface of the oral mucosa and bacterial plaque, from where it is then gradually released, thus extending its efficiency to up to 12 hours. It inhibits the colonization and growth of bacteria on the enamel surface, the deposition of dental plaque by 50-60%, the severity of inflammation by approximately 30-45%, and the number of bacteria in saliva by up to 95%. A remarkable advantage of chlorhexidine is its remarkable safety profile.

Lactoferrin is a multi-potent protein present in the milk and colostrum of many mammalian species, internal organs, mucous membranes, and saliva. It is a vital element when it comes to non-specific immunity. It has broad immunomodulatory, antibacterial, antifungal, antiviral, anti-parasitic, anticancer, and anti-inflammatory effects. The combination of chlorhexidine having a direct antibacterial effect and lactoferrin having an immunostimulating effect allows for treatment support and for the prevention of conditions resulting from hypersensitivity to bacterial biofilm that are typically associated with the excessive deposition of plaque and tartar.

References

2. Katarzyna Jodkowska: „Laktoferyna i chlorheksydyna – możliwości wykorzystania synergii działania w pomocniczym leczeniu chorób przyzębia u psów i kotów". Magazyn Weterynaryjny Nr 02 (luty) / 2021.
3. De Spain E.B.: Chapter 16: Prevention Strategies for Periodontal Diseases in Prevention in Clinical Oral Health Care. 2008, 213-229.
4. Lachenmeier D.W.: Chapter 20 – Antiseptic Drugs and Disinfectants. A Worldwide Yearly Survey of New Data in Adverse Drug Reactions, Vol. 39, 2017, 209-215.
5. Berlutti F. Pilloni A. , Pietropaoli M., Polimeni A., Valenti P.: Lactoferrin and oral diseases: current status and perspective in periodontitis. Annali di Stomatologia 2011; II (3-4): 10-18

STOMAFERIN ULTRA

COMPREHENSIVE, EFFECTIVE
AND CONVENIENT SUPPORT
FOR DENTAL THERAPY
FOR DOGS AND CATS
PARTICULARLY IMPORTANT SUPPORT
IN THE TREATMENT OF LESIONS
OF THE ORAL MUCOSA

RECOMENDATION of the Dentistry Section of Polish Small Animal Veterinarian Association
DENTISTRY SECTION OF PSAVA

THE FIRST PRODUCT ULTRA AN INNOVATIVE LINE

BI-DIRECTIONAL ACTION

- a unique combination of lactoferrin and chlorhexidine
- 2-in-1 action on the cause and the problem

GEL EFFECTIVENESS, CONVENIENT APPLICATION

- gel formula
- application with closed mouth

ANIMAL SAFETY

- does not cause salivation in dogs and cats

* has no medicinal properties

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